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OCT. 29, 1951

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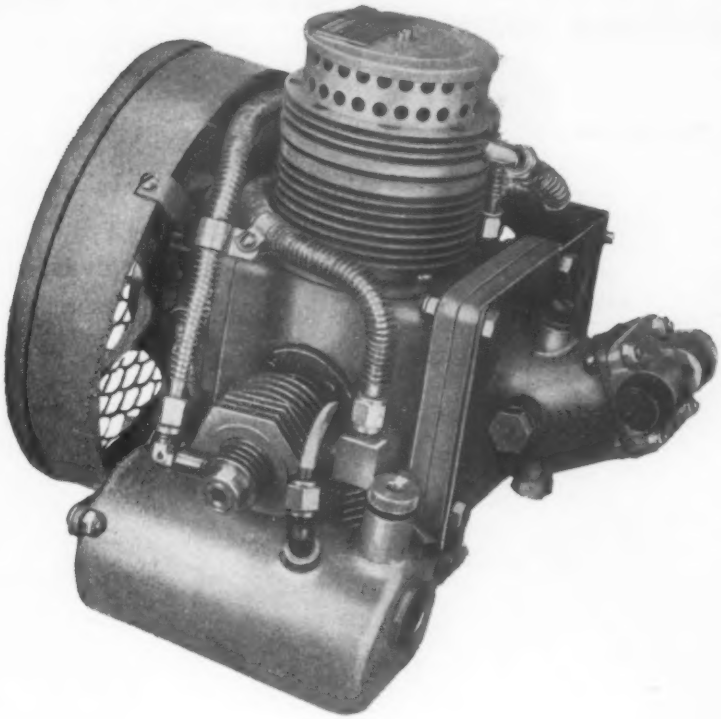

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Aviation Week

ABP Member ABC

Volume 55 **October 29, 1951** **Number 18**

Headline News

Ocean Coach Costs....13
AMC Ban on Bridges Lifted....14
USAF Orders New F-86 Sabres....14
Air Power's Record Peacetime Budget....15
AF Gives Nod to 'Voodoo'....16
CAB Urges Merger of MCA, CAL....17

Financial

Dividends Flying to New Record....18

Production Engineering

British Productive Giant Stirs....21
New Swedish Air Force Trainer....30
Details of Snarler Revealed....36

Equipment

New Ideas Spark Ignition Conference....44

Air Transport

Causes for UAL DC-6 Crashes....63
Centerline Runway Lighting....65
Power-Loss Signal Up to Pilots....66
First Ten 4-0-4s Due....67
Nonskeds Fly Billion Safe Miles....67

Editorials

They Didn't Wait for Subsidy....78
Being Realistic Is Difficult....78
It's Unpatriotic to Hurry?....78

Departments

News Digest....7
Aviation Calendar....8
Picture Page....9
Who's Where....11
Industry Observer....11
Off the Record....76
Washington Roundup....12
Expanding Industry....43
New Aviation Products....59
Also on the Market....60
Shortlines....67

37,739 copies of this issue printed

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Domestic News Bureaus: Atlanta 3, Rhodes-Haverty Bldg.; Chicago 11, 520 N. Michigan Ave.; Cleveland 15, Hanna Bldg.; Detroit 26, Penobscot Bldg.; Los Angeles 17, 1111 Wilshire Blvd.; San Francisco 4, 68 Post St.; Houston, 514 South St. *Correspondents* in more than 60 major cities.

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R. W. Martin, Jr., *Sales Manager;* J. G. Johnson, *Business Manager;* Anita Scaffo, *Research and Marketing;* Sales Representatives: J. C. Anthony, New York; M. J. Storz, Philadelphia; H. J. Johnson, Cleveland; L. J. Biel, Chicago; W. E. Donnell, St. Louis; James Cash, Dallas; R. C. Maultsby, Atlanta; R. F. Dorland, Jr., San Francisco; C. F. McReynolds, Los Angeles. Other sales offices in Pittsburgh, Detroit, Boston, London.

October 29, 1951 AVIATION WEEK Vol. 55—No. 18

Member ABC and ABP

Published weekly by McGraw-Hill Publishing Company, Inc., James H. McGraw (1860-1948), Founder. **Publication Office: 99-129 North Broadway, Albany 1, N. Y.**

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 18, N. Y. Curtis W. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Senior Vice-President, Publications Division; Ralph B. Smith, Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

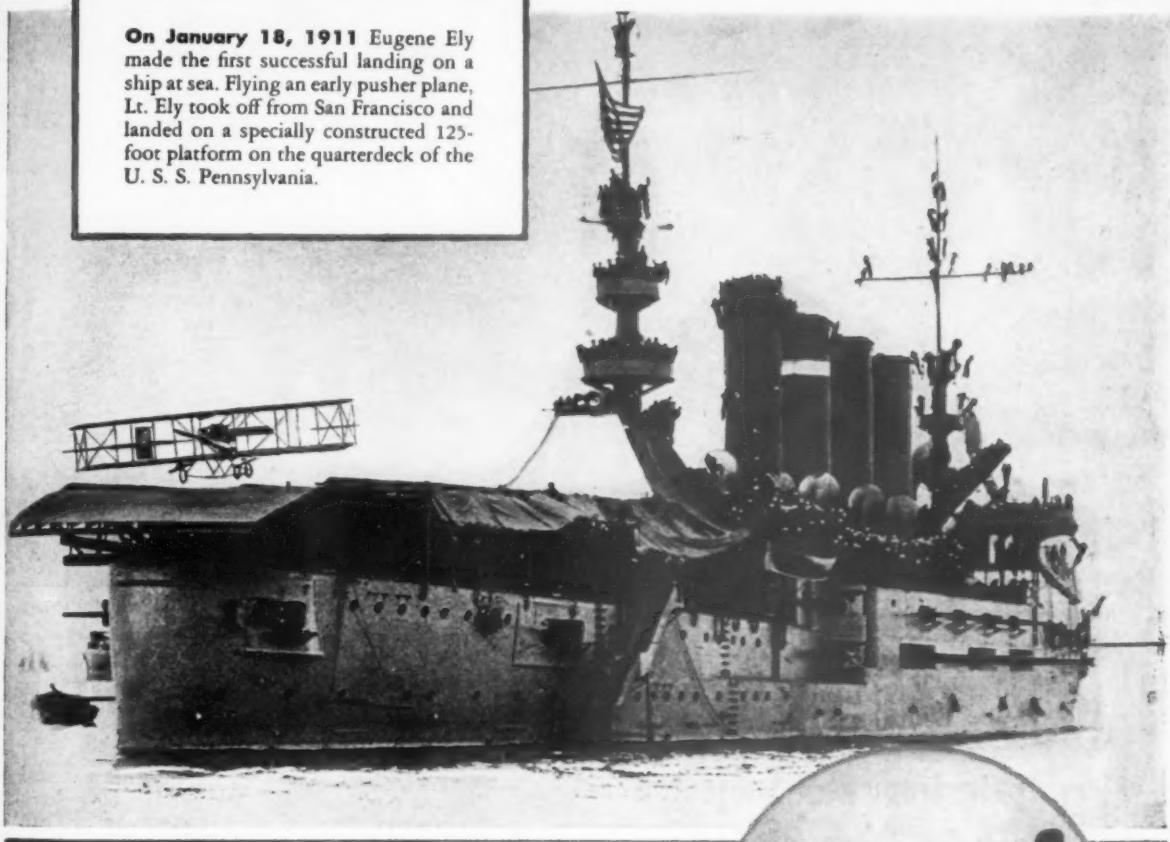
Subscriptions: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 N. Broadway, Albany 1, N. Y., or 330 W. 42nd St., New York 18, N. Y. Allow ten days for change of address.

Please indicate position and company connection on all subscription orders.

Single copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada, $8 a year; $12 for two years, $16 for three years, payable in Canadian currency at par. Pan American countries, $10 a year; $16 for two years; $20 for three years. All other countries, $20 a year; $30 for two years; $40 for three years. Entered as second-class matter, July 16, 1947, at the Post Office at Albany, N. Y., under Act of Mar. 3, 1879. Printed in U. S. A. Copyright 1951 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved. Cable address "McGraw-Hill New York." Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.

FIRST LANDING ABOARD SHIP – 1911

On January 18, 1911 Eugene Ely made the first successful landing on a ship at sea. Flying an early pusher plane, Lt. Ely took off from San Francisco and landed on a specially constructed 125-foot platform on the quarterdeck of the U. S. S. Pennsylvania.



Eugene Ely's pioneer landing aboard the U S S Pennsylvania was the beginning of shipboard aviation Although years were to pass before the U. S. Navy commissioned its first aircraft carrier, the Langley (converted from a collier), Ely's flight marked the dawn of a new era in naval strategy and tactics

Phillips Petroleum Company, pioneer in the field of special aviation gasolines and lubricants, has long been one of the country's largest suppliers of aviation fuels for military and commercial use. And now Phillips is ready with new fuels for turbo-props and jets, in addition to its tremendous capacity for producing 115/145 grade aviation gasoline.

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Phillips 66

AVIATION PRODUCTS

INSTRUMENTS ARE EXPOSED TO ULTRA-VIOLET RAYS TO DETERMINE THE EFFECT OF SUNLIGHT ON LEGIBILITY OF DIALS

Flight Tested Without Leaving the Ground

G-E Aircraft Instruments Subjected To Rigid Climatic Tests at Factory

A torture chamber with an engineer in charge is the new General Electric climatic test laboratory. To assure dependability, all G-E aircraft instruments are subjected to a series of tests which simulate and even exceed the conditions encountered in actual operation.

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SALT SPRAY TESTS are performed at 85 F with instrument immersed in 10% salt-water solution.

NEWS DIGEST

DOMESTIC

Eight Douglas DC-6Bs have been ordered by three airlines bringing total sales for this type to 137. New orders were placed by Continental Air Lines (2), Swissair and Compania Mexicana de Aviacion, three each.

James J. Strebig, 44, Associated Press aviation editor since 1943, died Oct. 19 in Silver Spring, Md., after a prolonged illness.

Douglas C-47 modified for Antarctic reconnaissance has been delivered by Transocean Air Lines to the Argentine Air Force. Plane is fitted with skis. Rato equipment and long-range tanks give plane duration of 18 hours.

Helicopter Council of Aircraft Industries Assn. will discuss the helicopter's commercial future at Nov. 2 meeting, Washington, D. C. Frank N. Piasecki is council chairman and Don R. Mockler is secretary.

U. S. altitude record for light seaplanes, set by Harold E. Mistele Sept. 3 in an Aeronca Sedan, has been approved by National Aeronautic Assn.

Edwin F. Schoch, 35, McDonnell Aircraft Corp. engineering test pilot, was killed Sept. 13 in the crash of an F2H Banshee near Lambert-St. Louis Airport. His test record included the FH1, XF2H-1, XF-85, XF-88, F2H-2, F2H-2P and F2H-3.

Personal and executive plane exports, of aircraft of 6,000 lb. and under, empty airframe weight, by six companies totaled 36 during September, valued at $169,068. Exports by the six companies for August totaled 19 worth $122,016.

Rocket motor production by Ryan Aeronautical is being increased ten-fold as a result of new orders received. Latest contract for missile motors is from Firestone Tire & Rubber Co., Los Angeles. Previously Ryan had built rocket powerplants for Douglas.

Thomas H. Beck, 70, former chairman of the board of Crowell-Collier Publishing Co., N. Y., and active in behalf of civilian flying, died Oct. 16 in Stamford, Conn. In 1941 he received the Frank M. Hawks Memorial Award for his aviation services.

Dr. Allen V. Astin has been appointed acting director of the National Bureau of Standards, succeeding Dr. Edward Condon. Dr. Astin worked on the proximity fuse for rockets and bombs during World War II and more recently has worked with government agencies dealing with electronics, ordnance, missiles and basic instrumentation.

FINANCIAL

Capital Airlines earned $1,225,171 net profit in the first eight months of 1951. Operating profit in August, 1951, was $476,614, with net profit (after taxes) of $298,528. Operating revenue that month was $3,615,080.

Delta Air Lines has declared a 25-cent quarterly dividend, the fourth this year. President C. E. Woolman stated that the carrier would show an estimated net profit of $1,135,000 before taxes for the quarter and net (after taxes) of $385,000. Total revenues were $5,945,000.

Douglas Aircraft Co. sales totaled over $150 million for the nine-months' period ended Aug. 31, and backlog was over $1,335 million. Net income for the period was $5,249,513, compared with $4,748,230 for the same 1950 period. Backlog was 89.5% military, 10.5% civil.

Northwest Airlines reports net earnings of $1,464,423 after provision for income taxes of $1,605,000 for the nine months ending Sept. 30. Total system revenues for the period came to $36.7 million; operating expenses were $33,330,259. A slight decrease in domestic passenger revenues, resulting from reduced schedules, was more than offset by a 33.8% increase in international passenger revenues.

INTERNATIONAL

Jetliner production has halted because of Avro Canada's extensive military commitments for the Canuck jet fighter and Orenda turbojet engine. The company is closing its New York office, headed by R. Dixon Speas, who is resigning. Some developmental and testing work on the Jetliner is continuing. The first of 124 CF-100 Canuck fighters was formally delivered to the RCAF Oct. 17.

Canso Catalina transport of Queen Charlotte Airlines, crashed into Mt. Benson, near Nanaimo, British Columbia, on Oct. 18 killing 23. The plane was enroute from Kemano, B. C. to Vancouver.

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AVIATION CALENDAR

Oct. 29-30—Air Industry & Transport Assn. of Canada, annual general meeting, Seigniory Club, Montebello, Quebec.

Oct. 29-31—National transportation meeting of Society of Automotive Engineers, Hotel Knickerbocker, Chicago.

Oct. 30-31—First world conference of flight engineers, sponsored by Flight Engineers International Assn., Lexington Hotel, New York.

Oct. 30-Nov. 16—Fifth Air Transportation Institute conducted by The American University, Washington, D. C.

Oct. 31-Nov. 1—Society of Automotive Engineers, fuels and lubricants meeting, Drake Hotel, Chicago.

Nov. 6-9—Symposium on the Physics and Medicine of the Upper Atmosphere, sponsored by AF School of Aviation Medicine and the Lovelace Foundation for Medical Education and Research, Plaza Hotel, San Antonio, Texas.

Nov. 7—Annual Wings Club Dinner, Waldorf-Astoria, New York.

Nov. 8-9—Seventh annual national conference on industrial hydraulics, sponsored by the graduate school of Illinois School of Technology and Armour Research Foundation, Sherman Hotel, Chicago.

Nov. 15-16—Seventh annual meeting of The Magnesium Assn., Biltmore Hotel, New York.

Nov. 16—Annual business meeting of the American Rocket Society, 29 W. 39 St., N. Y. 18, N. Y.

Nov. 27-30—Aviation Distributors and Manufacturers Assn. meeting, Waldorf-Astoria Hotel, New York.

Nov. 28-30—National convention of the American Rocket Society, Atlantic City, N. J.

Nov. 30-Dec. 5—Meeting of the American Society of Mechanical Engineers, Chalfonte Haddon Hall, Atlantic City, N. J. For information write: Ernest Hartfort, 39 W. 39 St., N. Y. 18, N. Y.

Dec. 4-5—Transport aircraft hydraulic accessory and system conference, sponsored by Vickers Incorporated, Hotel Sheraton, Detroit.

Dec. 6-7—Feedback Controls System, Chalfonte Haddon Hall, Atlantic City, N. J.

Jan. 5-6, 1952—Annual Miami Air Show, sponsored by the Florida Air Pilots Assn., Opa Locha Airport, Florida.

March 3-6—Institute of Radio Engineers, Waldorf-Astoria Hotel & Grand Central Palace, New York.

March 17-19—Second Midwestern Conference on Fluid Mechanics, to be held at Ohio State University.

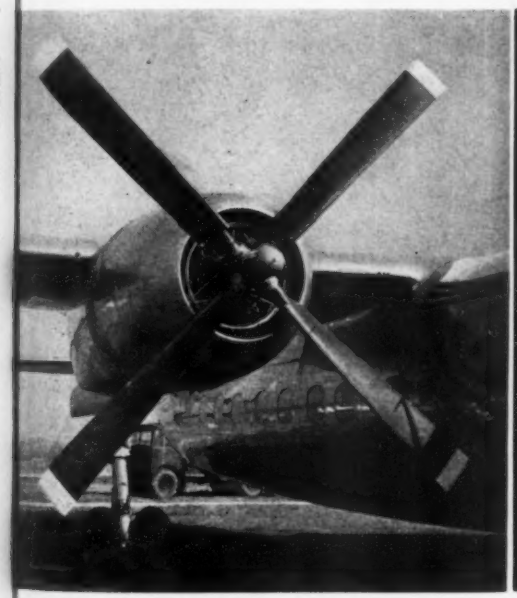
March 17-22—American Society of Tool Engineers, International Amphitheater, Chicago, Ill.

PICTURE CREDITS

9—(Forrestal) Steelways; 16-17—McDonnell Aircraft; 30—(bottom) Howard Levy; 36—(top) Keystone.

REVAMPED NORSEMAN—Being tested by Canadian Car & Foundry at Cartierville, Montreal, is new Norseman Mk. VII, which differs from earlier models by having longer, flat-sided fuselage and all-metal wings. Cabin access door has been moved aft.

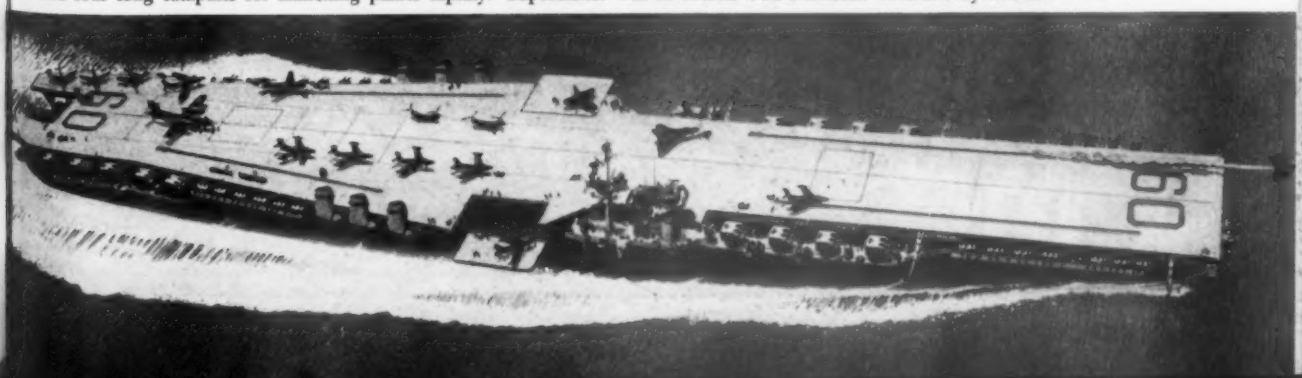
Plane News on Land, Sea and Air



NEW DH PROP—Hollow steel-blade prop on Airspeed Ambassador has 16 ft. 6 in. dia., is designed for turbines.

NEW DH NIGHTBIRD—First flight view of the new DH 110 multi-seat, twin-jet (2 Rolls-Royce Avons) night-fighter highlights craft's swept surfaces, close grouping of powerplants. Note very high stabilizer-elevator placement.

NAVY'S NEW SUPERCARRIER?—Artist's conception (below) of the Navy's upcoming $218-million supercarrier designed to carry latest jet fighters and bombers shows craft's very clean lines, with no obstructions visible on flight deck. The 1,040-ft. ship has multiple elevators and four long catapults for launching planes rapidly. Supercarrier will be named USS Forrestal. It is heavily armed.



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WHO'S WHERE

In the Front Office

James G. Byron and **Eugene M. Lokey** have been elected vice presidents of Curtiss-Wright Corp. Byron joined C-W last year as director of industrial relations, coming from Bendix Aviation Corp. where he had held a similar post. Lokey also joined the company during 1950, previously was vice president public relations for the N. Y. Stock Exchange.

Henry F. Argento has been named an assistant vice president of Raytheon Mfg. Co., Waltham, Mass., and also is designated assistant manager of the Power Tube division. Argento joined the firm in 1932, has been sales manager of the division since 1941.

J. B. Waskey has been promoted to assistant to the vice president-production of the Pacific Airmotive Corp. He formerly was manager of the engine division, Burbank, a post now filled by **L. B. Littrell.**

Floyd H. Lawson, Jr., has been designated staff assistant to the vice president-general manager of Link Aviation, Inc. A former Air Force bomber pilot, Lawson was with Bendix-Westinghouse Air Brake Co. during 1946-1949.

Changes

Quentin G. Turner has been named manager of industrial engineering for Convair's guided missile division. In other Convair staff changes, **W. A. Clegern** has been made chief of engineering flight tests at Fort Worth. Other changes here: **D. C. McDougal** and **J. J. Minton** were transferred to the new master planning section as project administrators, **A. F. Thompson** was made chief of production control, succeeding **A. L. Barnett,** who became assistant chief tool engineer. **O. A. Dworak** has been named chief of subcontracts. At Convair-San Diego, **D. C. Loomis** has been designated manager of the B-36 program at San Diego. **P. M. Prophett** has been named manager of flight and **G. A. Covington** has been appointed manager of quality control.

W. A. Bortner has been made assistant chief project engineer-aircraft for Glenn L. Martin and **J. D. Rauth** has been named assistant chief project engineer-weapons.

John N. Eustis has joined Piasecki Helicopter Corp. as subcontracts manager; **Richard J. Donnelly** has been named assistant to the director of personnel administration; **Ralph O. Johnston** has been made master planning administrator and **Arthur Weber** is new assistant superintendent of production control.

Travel Log

J. W. Miller, sales manager of Piper Aircraft, and **Frank Sheridan Jonas,** export representative, have left New York on a six-weeks European tour, during which they will demonstrate the Piper Super Cubs and attend a United Nations meeting in Rome which will discuss means of combatting the Middle East locust plague.

INDUSTRY OBSERVER

► **Better means of distinguishing between the Allison J-35-A-23 and the General Electric J-35-GE-23 jet engines, which are both radically changed from the earlier basic J-35 engines with smaller dash numbers, is going to simplify this aircraft industry problem. The Allison dash 23 will be redesignated J-71 and the GE dash 23 will now become J-73.**

► B. F. Goodrich and Boeing have jointly developed a "surge boot" for the Boeing flying boom refueling system, a 15-lb. rubber cushioning device to damp out the sudden hydraulic ram effect experienced in the fuel line when the high speed fuel flow is suddenly cut off. The production version is described as the product of long testing and development, from difficulties in meeting stringent Air Force service requirements.

► **Some Navy pilots who have flown jets on tactical missions argue with the Air Force contention that they are more stable firing platforms than piston engine fighters. The smooth flight of jets at high operating speeds is complicated by vibrations experienced when they lower flaps and dive brakes to slow down for ground support missions, they say.**

► Convair's new order for turboprop-powered T-29 trainers will be for three airplanes at the outset. They will be powered with Allison T-38s, and will use the new basic Convair 340 airframe since Convair is not now making 240 airframes such as were used for the earlier T-29 navigation and bombardier trainers. Previous T-29 models include, besides the original T-29, a pressurized T-29A and an unpressurized T-29B. This indicates that the turboprop plane will probably be the T-29C unless the airframe modification is considered sufficiently great to warrant a completely new series designation in which case it may be the T-37.

► **Corrosion of shipments of some de Havilland Vampire jet fighters purchased by the Royal New Zealand Air Force, has slowed up assemblies of the planes on arrival and some have had to be scrapped because corrosion was so far advanced.**

► Dodge division of Chrysler Corp. recently has been picked to manufacture Hamilton Standard steel four-blade propellers for the Boeing C-97 Stratofreighter transports. This order indicates that probably Pratt and Whitney R-4360 engines will continue standard on the C-97s and that the turboprop Stratofreighter version is not expected to go into quantity production very soon.

► **One aspect of dual-purpose plant construction, such as is being sponsored by General Motors Corp. for aircraft war production alternately with automobile civil production, is the lesser proportion of accelerated amortization that may be claimed for such plants. It probably would be rated less if much of the plant space is useful in peacetime production, thereby cutting down total accelerated amortization for defense which is reaching a size viewed with alarm in government circles.**

► NACA makes an impressive demonstration of how it reduces vibrational amplitudes of jet engine compressor blades by the simple expedient of introducing a molysulphide lubricant between the blade root and the socket in which it fits.

► **Boeing's 200-hp. gas turbine already has made flights totaling several hours in the air in a test installation in the Cessna L-19 Air Force liaison plane, normally powered with a Continental piston engine rated at 213 hp. for takeoff. It also is due to make its first flight soon as a helicopter powerplant, presumably in the Kaman helicopter, under an experimental contract recently awarded.**

► Air Force announcement that the British-designed Sapphire J-65-W-1 engine will power the Martin-built Canberra J-57 twin-jet bomber confirms the first report in AVIATION WEEK Feb. 19 that this powerplant was slated for Martin's Canberras. The definite scheduling of the Curtiss-Wright-built Sapphires for the British-designed intruder bomber may be another factor in the switch from Republic F-84F jet fighters announced last week (AVIATION WEEK Oct. 22, p. 13). The postponement of the F-84F schedule means that some Sapphires, which those planes would have used, will be available now for the Canberras.

Washington Roundup

Secretary Sawyer: Last Words?

Secretary of Commerce Charles Sawyer is talking like a man about to leave the Administration—giving it a going-away barb while his rank still commands an audience.

The Secretary fought a losing battle with Defense Mobilization Director Charles Wilson over control of the mobilization program. Sawyer would have constricted Wilson to generalized policy matters, lodged direction of the program in Commerce. He's never resigned himself to the defeat, continued to urge Commerce control.

In Cleveland last week, Sawyer attacked loose federal spending, demanded cuts in non-essentials, then went on to ridicule the "mania for new agencies, commissions and study groups," as adding more expense.

Washington awaits President Truman's response to the attack by his Cabinet officer.

Should Sawyer leave, Undersecretary of Commerce for Transportation Delos Rentzel is a prospect to succeed.

Mr. Republican's Defense Plank

Defense platform announced by the Republican Presidential contender, Sen. Robert Taft, is notable because it doesn't challenge the Administration defense program —only punctuates it with a question mark.

Taft has shelved his brief for a "go it alone" defense against Russia, which would mean all-out strategic air power back-stopped by an adequate naval force and minimum ground force.

Only eight months back he spurred the stormy, but unsuccessful, Senate opposition to the Administration's plan to dispatch divisions to Europe on the argument it would mean a "land war" to hold the Continent.

There are two main factors behind Taft's seconding military "containment" of Russia at this time:

• **Political:** Taft supporters shy from the "isolationist" tag that "going it alone" would carry. And they don't want to furnish an issue that might provoke Gen. Dwight Eisenhower, heading up European defense, to challenge Taft for the Republican nomination.

• **Technological:** Tactical atomic firepower now opens the prospect of a superior Allied tactical air arm being able to hold Europe with numerically outnumbered ground forces. Tactical A-weapons were little more than hoped for early this year when Taft proposed the "go it alone" program.

On the positive side, Taft recommends a civilian-military commission to set a ceiling on the defense outlay the economy can support, and, within this, shape the military program.

He told the news conference at which he announced his candidacy:

"It is the over-all expense that worries me in the present situation . . . I have felt that there should be a complete reappraisal of the whole program of anti-Soviet military action, because I think that it is reaching a size by 1953 and 1954 which will really be a serious threat to the economic stability of the U. S.

"I would like to see the whole thing re-studied by a commission of military and civilian personnel to decide what kind of a war we might face in a World War III, what our objectives will be, what our economic limitations are, and therefore, what this program should be in the military field."

Taft's Military Advisors

These are Taft's three military advisors—the men who would mold defense policy in a Taft administration:

• **Gen. Douglas MacArthur,** generally credited as the original author of the now abandoned Hoover-Taft program for all-out strategic air power.

• **Brig. Gen. Bonner Fellers,** Ret., a former MacArthur staff officer, who, as military advisor to Republican National Committee, (where he still serves), pushed the air power program.

• **David S. Ingalls,** Taft's cousin, Assistant Secretary of Navy for Aeronautics in the Hoover Administration. He holds a commodore rank in the Naval Reserve, has been on Pan American World Airways' board of directors since 1945.

Contract Canceling?

A factor in Congress' eagerness to appropriate even more funds than requested for planes: It doesn't add to present inflation. Most of the money allowed Air Force and Navy now for plane buying actually won't be "spent" until 1953 and 1954, when the aircraft are delivered.

A big air power program can be had, on paper, with little pain to the economy now.

And if the pain grows too severe in '53 and '54, or the international situation brightens, contracts can be canceled, congressmen reason.

Sen. Joseph O'Mahoney, chairman of the Senate Appropriations Subcommittee on the Armed Services, told Air Force officials at a hearing: "Contracts can be written upon a reasonably contingent basis, so that as the years go by, when you get into the 1954 and 1955 fiscal years, and the situation has changed, you would know what to do—these contracts would be cancelable."

What to Expect

► **Gas hike from 1.5 cents a gallon to 2 cents Nov. 1.** The boost will add millions of dollars to airline operating costs. But not as many as the boost to 3 cents urged by the Administration.

► **An airing of differences in Army, Marine, and USAF concepts of tactical support before House Armed Services Committee.**

Second ranking Republican member, Rep. Sterling Cole, says he will insist on it when the new session convenes in January. The new law establishing a Tactical Air Command as a "must" arm of USAF, Cole comments, "doesn't solve the issue, at all. We want to find out how much emphasis the Air Force is going to put on tactical aviation in its build-up. It's always been treated like a step-child by the Air Force."

► **National transportation program by the end of the year.**

Being drawn under the direction of Undersecretary of Commerce for Transportation Delos Rentzel, its objective is to streamline the transportation route structure and provide for fair and equitable treatment, of all types of carriers with regard to government support.

Rentzel is emphatic that his office will only "recommend" actions to effectuate the program, and will not intrude on the independence of CAB and other transportation agencies. But some senators are skeptical.

—Katherine Johnsen

AVIATION WEEK VOL. 55, NO. 18 OCTOBER 29, 1951

Plane-by-Plane Costs for Air Coach

(Plus 14% Profit Per Flight)*

If a—

	DC-4	DC-6	DC-6B	749A Connie
Costs this much to operate at capacity *(Cents per seat mile)*	4.51	4.83	4.47	5.02
And carries this many passengers ..	53	65	80	60
Then the cost per passenger* * New York to Shannon would be:				
Full load	$147	$158	$146	$164
80% load	184	197	182	205
75% load	196	210	194	218
70% load	210	225	208	234
65% load	226	243	225	252

** Figures represent cross section of obtainable trans-Atlantic airline cost estimates, including 14.3% operating profit return.*

*** One-way cost, assuming half the passengers purchased 10% discount return tickets.*

Note: These estimates may be prejudiced by fact some carriers favor, some oppose starting such service soon. Hence other trans-Atlantic carriers may challenge legitimacy of some or all of these cross-section estimates.

Ocean Coach Costs Shown

- **Maximum $250 one-way fare New York-London expected to be proposed by U. S. carriers.**
- **But PanAm ready to start service next April at $225 figure ($405 roundtrip), and predicts 75% loads.**

By F. Lee Moore

U. S. and foreign airlines spanning the Atlantic will make an historic decision in the coming month; it may carve out a bigger chunk of trans-Atlantic travel business for air carriers than they have ever known.

In the next two weeks, all the scheduled trans-Atlantic airlines will prepare their final cases for and against starting unlimited air coach service across the Atlantic next spring. They will make their final decision on this issue at Nice, France, on Nov. 20.

Pan American World Airways has sparked the drive to start trans-Atlantic air coach service Apr. 1 at a fare between $225 and $250 one way ($405-$450 roundtrip).

▶**May Compromise**—Thwarted by previous delays, PanAm's President Juan Trippe has even offered to break the International Air Transport Assn. rate agreement structure and go it alone at $225 next Apr. 1 if the other trans-Atlantic carriers don't agree to it jointly.

From their briefing for the Nov. 20 IATA meeting last week with Civil Aeronautics Board, PanAm and TWA came away with permission to bargain with a $237.50 one-way fare proposal as a $225-$250 compromise.

Outlook is for an IATA settlement next month on a maximum $250 one-way air coach fare (New York-London $450 roundtrip), according to some airline and CAB observers. This compares with standard service now costing $711 round trip New York-London. The air coach fare would lower costs for visiting all of Europe as well—for instance, one-way fare to Shannon, the European gateway, would be only $221.

CAB has already gone on record favoring trans-Atlantic air coach next spring, at one-way fare between $225 and $250. CAB even nullified the air coach agreement of last spring on ground it was too vague in some respects and it allowed for arbitrary trip limitation.

▶**How Many Passengers?**—But CAB demanded definite agreement on seating density of the planes before it would subscribe to any fare. How many passengers the planes will safely carry is the primary factor in air coach service economies.

Latest obtainable trans-Atlantic airline cost-with-profit figures designed to find a fair coach fare are shown in table (left). The average of the seat mile cost-with-profit figures for the four planes considered comes to 4.71 cents. This compares with the figure agreed to by the airlines in the IATA cost committee of 4.63 cents a seat mile for a full airplane. Revenue per plane with full load would be 7.1 cents a seat mile on a $250 one-way fare. Main problem then comes down to how much load factor is fair to figure for a coach service at such a fare.

▶**Estimating the Cost**—Airlines of IATA finally agreed that 4.63 cents a seat mile was a fair composite cost-plus-profit figure for full load New York to Shannon. Here is how they work that basic cost figure:

It's 3,108 miles from New York to Shannon. At 4.63 cents a seat mile full load, the cost-plus-profit figure per passenger for the full trip to Shannon one way is 3,108 miles times 4.63 cents per seat mile, or $143.90 total. If you figure half of the people going one way have bought a roundtrip ticket the one-way yield is $151.47.

Now lower the expected load factor to 70% and you get $216.38 composite cost-plus-profit figure for each passenger, New York-Shannon. For the Shannon-London hop everybody figures $29 per passenger.

That makes total New York-London composite cost with fair profit per passenger for the trans-Atlantic airlines $243.38. So the airlines have agreed that if they can count on a 70% load factor on trans-Atlantic air coach, a $250 one-way fare ($450 roundtrip) covers their composite cost-plus-14% profit estimate.

If you figure on a 75% load factor, as Pan American claims you can, the composite cost plus fair profit per passenger New York-Shannon is $210.96—or $230.96 New York-London.

▶**Setting the Fare**—Pan American says the carriers may count on a 75% load

factor for air coach because first-class load factor first half of this year has been 65%. "Tourist-class service everywhere in the world has always achieved at least a 10% higher load factor than first class service," says PanAm.

Some observers assert that assuming a 75% load factor, the cost of $230.96 New York-London cost-plus-profit factor is inflated by figures presented by carriers opposed to starting the service at this time. PanAm says even on cost figures alone a $225 one-way ($405 roundtrip) fare is a profit-maker.

PanAm says, "Never have fares been set on cost alone." There is a creative element in lowering fares, leading to more demand and less overhead per unit, PanAm points out. Yet even leaving out this vital favorable factor, a $225 one-way or $405 roundtrip fare proves out on cost alone. "PAA is willing as a matter of business statesmanship, to gamble on the $405 fare, instead of the $450 fare ($250 one way)."

But the IATA majority is likely to take the higher figure. IATA's cost committee figures $450 roundtrip coach fare is fair enough by the following calculations: Take 65% as the average load factor; allow 17% of the revenues for operating profit; allow an additional 5% hedge against inflation; allow no reduction in overhead, despite increased volume of service—reduced overhead per unit. The IATA cost committee, by the above conservative figuring, arrived at a $450 fare roundtrip, $250 one way.

► **Government vs. Their Airlines**—At the recent IATA conference no decision was made on the air coach proposal of the Americans. Observers felt that many foreign airlines opposed the low-fare coach even though their top government policy favored the program. Their spokesmen paid lip-service to starting coach fares soon, but demurred on specifying the proper fare and the proper date.

Even though they are government controlled, some foreign airline managements consider first their own subsidy reduction rather than overall welfare, it was pointed out, since profit and loss of the airline is the prime consideration of management. Some airline managements don't want to risk low-fare service because they fear they may run at a loss for a while.

But top government policy of most of these countries is that even though there could be a few dollars more air subsidy to bring each American tourist over, the dollars each would spend abroad would be many times the subsidy to get him over.

That's why American observers are confident this next month's deliberations will yield international agreement on a $250 one-way coach fare New York-London.

Help Promised

After conferences at Wright-Patterson AFB on materials allocations with approximately 50 of the top Air Force and Navy aircraft and engine contractors, Defense Department officials returned to Washington last week prepared to go to bat with the Defense Production Administration for the actual materials requirements of air power.

Chances appeared good in Washington last week that Aircraft Production Board and DPA would substantiate the finally reviewed requests presented by the Defense Department for aircraft materials.

Best guesses were that the reviewed materials schedules would be submitted by the Defense Department by early this week.

► **Who Gains from Low Fare**—Pan American offers the following run down on benefits of a truly low-fare air coach service next spring (maximum $250 one way):

- **Middle-income man.** Middle-income American's living standard goes up when a vacation in Europe is priced and timed within his reach.
- **Foreign policy.** More foreign travel means more understanding.
- **National defense.** More over-ocean traffic volume means more allied airlift reserve available at any moment. Also, more dollars spent abroad means more European re-armament.
- **U. S. taxpayer.** Dollar spending abroad by tourists means less U. S. taxpayer dollars to European recovery.
- **Foreign benefits.** U. S. tourist spending abroad is net profit to the countries in which the dollars are spent.
- **Travel industry.** Agents and others gain from business expansion inevitably going with lower fares.
- **Airlines.** More revenue should help arrive at lower subsidy need.
- **Aircraft manufacturers.** More traffic means more plane orders.

► **TWA Objects to PAA Tactics**—A TWA spokesman says PanAm killed earlier agreement on air coach by a "Gromyko walkout." He says just when the IATA members were ready to go along with a $265-275 one-way rate, PanAm walked out, insisting on $250 maximum or none.

But PanAm answers by saying that since you can raise the number of passengers 50% in coach seating, the two-thirds drop in fare paid per passenger is fully made up—and hence PanAm's stand on lowest coach fare possible is backed by simple arithmetic.

AMC Ban Against Don Bridges Lifted

Dayton, O.—Don Bridges, representing Introductory Service, Inc., has been returned to full status as a representative at Wright-Patterson AFB, Air Materiel Command officials announced.

Bridges and another representative had been suspended temporarily pending outcome of a hearing by the Office of Secret Investigations (OSI) at the Air Force base.

In connection with the case, AMC issued the following statement:

"Following a thorough analysis of investigating reports pertaining to the case of Mr. Don Bridges, it was concluded that the information contained therein was insufficient to warrant continuance of the action taken on Oct. 2. Mr. Bridges will be authorized to visit Wright-Patterson Air Force Base in accordance with standard procedure for manufacturers' representatives."

Bridges revealed that questioning by OSI concerned alleged connections with a contractor who recently had a major contract canceled because of procurement irregularities. The hearing disclosed that he had no connection with the contractor, Bridges said, resulting in his exoneration.

USAF Orders New F-86 Sabre Models

North American Aviation last week announced Air Force orders for two later and more powerful sweptwing F-86 Sabre jet fighters—the F-86F to be produced at the North American's Columbus, Ohio, plant, and the F-86H to be built at Los Angeles.

The F-86H will be slightly larger than Sabres now flying but will have the same general lines. Its entire horizontal tail surface will be power-boost controlled but will be somewhat larger and without the dihedral in the all-moveable tail of the F-86E. It will have an improved suspension and release mechanism for droppable wing tanks, bombs, and rockets, improved type pilot seat ejection mechanism, and a canopy of clam shell type such as is used on the F-86D. Armament will include 50-cal. machine guns.

The F model is in many respects similar to the E now in production but both planes will have more powerful GE J-47 engines than those currently used in the F-86E.

Presumably the orders were in connection with procurement shifts disclosed in AVIATION WEEK Oct. 22 issue, involving the F-86 and the Republic F-84F. These involved the deferral of the F-84F and a production step-up on the F-86F.

Air Power's Record Peacetime Budget

Current 1952 fiscal year funds for air power, now enacted, pass the $28-billion mark—double the total pre-Korea defense budget.

And, the plan now is for an additional $5 to $10 billion in January to expand air power beyond the present target of a 95-wing Air Force and 14-carrier-group Naval air arm to a 140-wing USAF and 20-carrier-group Navy.

The division among the services of $60.7 billion for defense (with $500 million earmarked for the Secretary of Defense) already enacted this year points up the fact that air power now plays the dominant role and that USAF is now the dominant service. The split:

- **Air Force,** $20.6 billion.
- **Army,** $20.9 billion.
- **Navy,** $16.7 billion (including $5.5 billion for the air arm and aviation facilities.)

Here is how the funds will bolster air power:

- **Planes.** The $7.8 billion for complete aircraft will provide for the financing of 8,690 USAF planes, 3,092 of which have already been ordered and partially financed, and purchase of 3,700 Naval planes.

In addition USAF has allowed $667 million and Navy $333 million for plane procurement. So they may let contracts late this year and early next year to equip the air arms with modern planes after mid-1953.

Also, Army has $44 million, most of which will go for helicopters.

- **Guided missiles.** The $130 million allocated USAF contemplates procurement of five types of missiles. With its $33 million, Navy hopes to complete production of a sufficient number of each of two types of missiles to permit service evaluation, training by mid-1952.
- **Helicopters.** Over $200 million is earmarked for some 800 rotorcraft (Navy, $160 million; Army, $40 million; USAF, $12 million).
- **Industrial plant.** With $1.1 billion for USAF and $466 million for Navy, the expansion of the industrial base for aircraft and related production will be completed by late '52.
- **Public works.** The $2.3 billion for USAF and Naval air public works looks to a major expansion in research and development facilities, particularly for guided missiles and rockets and construction of overseas bases.

Air Force and Naval aviation have been allocated their biggest peacetime budget by the current 1952 fiscal year Military Appropriation Act and Public Works Supplemental Act. Here is how funds for 1952 stack up with those allocated for 1951 fiscal year:

	Last year (1951 fiscal year)	This year (1952 fiscal year)
Air Force	$15,791,061,000	$22,713,985,000
Naval air	4,010,322,000	5,556,393,000
Total for air power	19,801,383,000	28,270,378,000

With these appropriations (some of which will go for payments on old contracts and carry-over funds), the two air services plan these new obligations:

U. S. Air Force

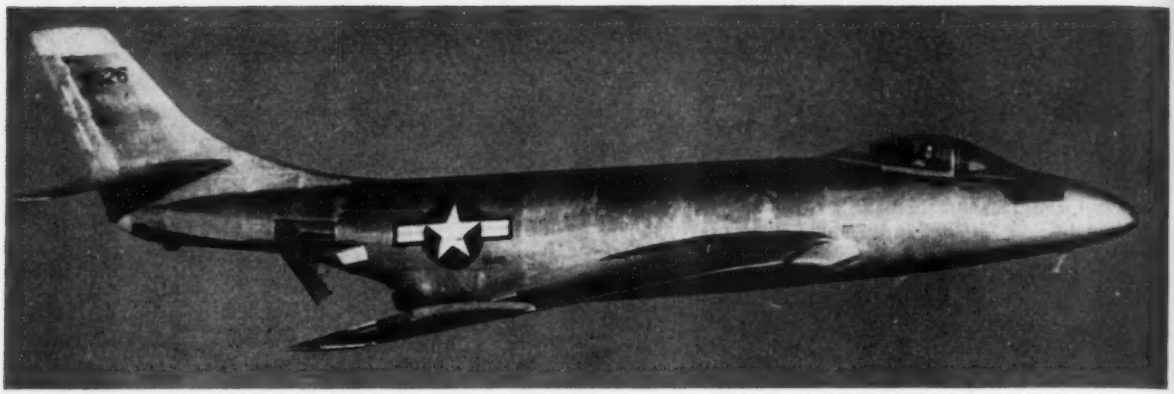
	Last year (1951 fiscal year)	This year (1952 fiscal year)
	(000 omitted)	
Aircraft and related procurement	$7,027,453	$11,257,800*
Complete aircraft	3,226,342	4,457,360
Initial spares and parts	1,878,384	4,197,035
Industrial machinery, factory expansion, training items, ground handling equipment	1,338,358	1,478,025
Modification and modernization of aircraft	222,814	263,420
Guided missiles	149,993	130,000
Industrial mobilization	79,840	9,380
Major procurement other than aircraft	1,021,214	1,775,000
Electronics and communications equipment	488,569	379,167
Training equipment	86,447	93,085
Meteorological, radiological photographic, test and flying field equipment	330,100	242,580
Research and development	368,020	425,000
Maintenance and operations	$3,024,218	$3,208,442

** This includes $667,000,000 not yet earmarked, most of which will probably go for purchase of complete aircraft.*

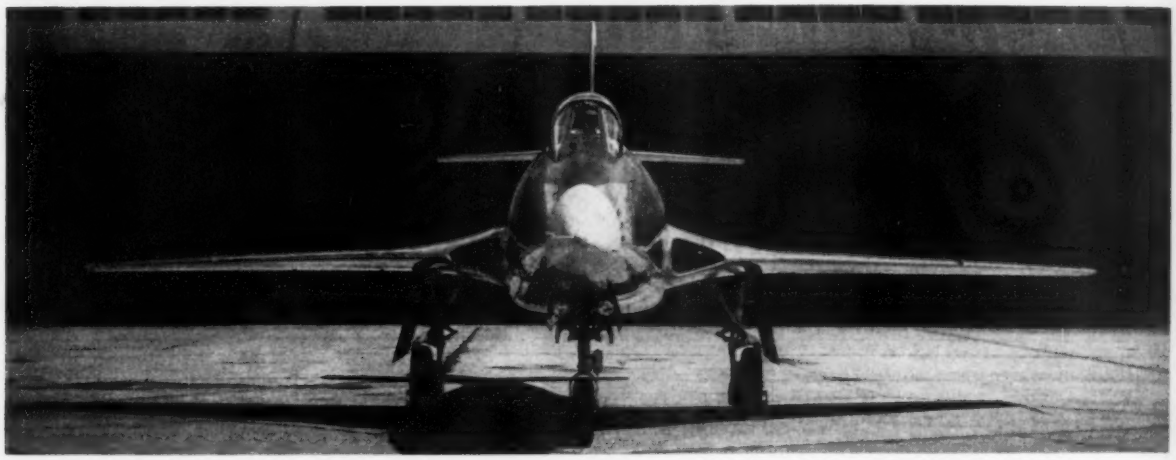
Naval Air

	Last year (1951 fiscal year)	This year (1952 fiscal year)
	(000 omitted)	
Construction of aircraft and related procurement	$3,042,922	$3,882,476**
Aircraft	2,771,434	3,426,854
Ordnance for new aircraft	57,741	49,056
Guided missiles and target drone procurement	101,261	33,425
Technical equipment for service training	4,735	10,938
Aircraft modernization	107,751	29,203
Aircraft and facilities	929,388	925,393
Aircraft overhaul	267,573	281,668
Research and development	130,262	159,729
Industrial mobilization	29,354	6,221

*** This includes $333,000,000 not yet earmarked, most of which will go for aircraft.*



F-88 VOODOO is to be ordered into production for the Air Force as a long-range escort fighter. This side view, and . . .



FRONT VIEW plus photo on opposite page give a photographic three-view of McDonnell's twin-jet 700-mph. plane.

AF Gives Nod to McDonnell 'Voodoo'

• Programmed for production 2 years ago, twin-jet was shunted aside in favor of Lockheed F-94D.

• Even now SAC support fighter has no home; initial work to be done at St. Louis, but future is indefinite.

After more than a year on the shelf, McDonnell Aircraft Corp. twin jet XF-88 "Voodoo" fighter is to be ordered into major production by the Air Force. The plane, one of this nation's longest-ranged jet fighters, will serve to escort Lt. Gen. Curtiss Lemay's Strategic Air Command bombers.

It is expected that McDonnell Aircraft contract will replace a previous contract to the Lockheed Aircraft Corp. for F-94D escort fighters. Proposed procurement of the F-94D has been canceled because of producibility difficulties.

It is unlikely that McDonnell Aircraft will build the plane at St. Louis, because all available major Air Force production facility there are now committed to Navy F2H and F3H production.

The only major Air Force facility yet unassigned is the Omaha-Glenn L. Martin Nebraska plant which during World War II built Boeing B-29s. Most of this facility, however, is occupied by the Strategic Air Command headquarters and there are no present plans to move that headquarters, it is learned.

▶ **Up to McDonnell**—This indicates that another plant at another location will be built for F-88 production unless manufacture of the plane is diverted to another company.

Some speculation on this point was immediately knocked down by industry observers who stated that production under the initial contract would have to be undertaken by McDonnell. If requirements are then further increased, it was pointed out, then a second supplier—probably an automobile manufacturer—may be called into the picture.

The Voodoo is powered by two Westinghouse J-34-WE-22 engines each of which is rated at 3,600-lb. thrust with afterburner. Intake ducts are located at the wing-roots and the engines exhaust just aft of the wings and below the tail. Wings and tail surfaces are swept back 35 degrees. Its top speed is reported as over 700 mph.

Pilot's compartment is pressurized and bullet proof. Armament includes six 20-mm. cannon and under-wing fittings for rockets and bombs. Fuel capacity is 1,400 gal. without wing-tip tanks, giving the craft a normal range rated at 1,725 mi. Production contract undoubtedly will call for wing-tip tanks and provision for aerial refueling. Production version will be designated F-88A.

▶ **150-300 Planes**—The F-88 has had

PLAN VIEW of the Voodoo is shown in this "on top" photo.

▶**150-300 Planes**—The F-88 has had a stormy procurement career. Programmed for production two years ago, it was then struck from Air Force projected procurement during the defense economy edict of 1949. In June of 1950 the F-88 was evaluated by the Air Force in competition with the Lockheed F-90 and the North American F-93 (F-86C) at Edwards AFB, Calif., to determine which was best suited to meet USAF escort requirements.

Previous planning had indicated that the winner would be recipient of a 150-300 plane order (AVIATION WEEK June 26, 1950, p. 13). Although the F-88 emerged undisputed winner of the evaluation, Air Force meanwhile had decided to press for heavier emphasis on fighter-bombers and as a result, the fighter-escort program was shelved.

Chances are that F-88 procurement will be considerably increased over the first contract because of Army interest in the long-range capabilities of the fighter. Army has long favored the F-88 (AVIATION WEEK Aug. 28, 1950, p. 13) because of its suitability as a tactical support fighter.

▶**Ground Support**—Army interest in the F-88 waxed even hotter a year ago when some consideration was given by the Air Force to ask McDonnell for a turboprop version of the plane. From Army point of view this would simply extend legs of the F-88 even further and make it still more desirable for tactical support of ground troops. Army viewpoint is that the only trouble with most jet fighters is that their endurance and range are far too low.

Air Force, however, ordered the experimental turboprop version of the F-88 only as a flying test bed for the engine and apparently gave little serious consideration to its development to major production. Later switch of the flying test bed to another company's program resulted in cancelation of the F-88 turboprop test program.

Of prime interest to the Strategic Air Command is the F-88 long range combined with its maximum speed in excess of 700 mph. Military requirements demand that fighters provide sufficient speed margin over the high subsonic speeds of long-range bombers now in operation. The speed advantage of current jet fighter equipment over jet bombers such as the B-47, B-45 and the coming B-52 and B-60 heavy bombers is considered to be inadequate.

▶**Twin Reliability**—Most single-engine jet fighters are unable to fill the long-range requirement needed in strategic escort operations. While refueling in the air modifies this requirement to a degree, it is neither satisfactory nor expedient from a logistics point of view if more than one refueling rendezvous is needed, it was pointed out.

Twin engine reliability of the F-88 and the fact that the plane is able to cruise on one engine are strong factors in favor of the planes' selection.

Performance of the XF-88 includes a maximum speed of over 700 mph. and a rate of climb of 6,000 fpm at sea level. The plane has a gross weight quoted officially as "over" 20,000 lb. and an empty weight of 12,000 lb. span is 39 ft. 8 in.; length 54 ft. 1.4 in.; and height is 17 ft., 3.2 in. Complete design analysis of the McDonnell F-88 was published in AVIATION WEEK Sept. 4, 1950, p. 27.

CAB Urges Merger Of MCA, Continental

Merger of Mid-Continent Airlines and Continental Air Lines was proposed last week by the Civil Aeronautics Board. CAB said that separately the two route structures are weak and require heavy subsidy. But together, they would require about $1 million less subsidy a year than now.

CAB issued an order that the two airlines "show cause why the Board should not find that the integration of the routes. . . into a single unified system. . . would be consistent with the public interest."

CAB cannot force airlines to merge. So it is taking this way to show the managements and stockholders of the carriers that it would be good economics for them to merge. CAB did the same thing a month ago for the East Coast route structure, proposing an investigation of merger possibilities of Northeast/Colonial with either National or with Delta plus some part of Capital's routes.

Shifted by USAF

Col. Kern D. Metzger, USAF, has been transferred to Wright-Patterson AFB, Dayton to head a new combined setup embracing Aircraft Production Resources Agency, and the Industrial Resources division of Air Materiel Command.

Col. George Schaetzel, who has been Air Force member of APRA has been transferred to the staff of Maj. Gen. Mark Bradley, Jr., AMC, Director of Procurement and Industrial Planning.

Trunkline Cash Dividends

Calendar Years 1947-1951

	1951*	1950	1949	1948	1947
	(000 Omitted)				
American	$4,627	$3,013	$1,400	$1,400	$1,400
Braniff	500	250	...	...	...
Capital	...	...	...	...	...
Chicago & Southern	509	255	178	...	...
Colonial	...	...	...	...	...
Continental	77	77	...	...	...
Delta	500	250	125	...	...
Eastern	1,198	599	...	...	599
Mid-Continent	105	208	199	97	...
National	500	...	...	...	...
Northeast	44	79	40	...	...
Northwest	443	111	224	112	218
TWA	...	...	...	...	...
United	3,566	1,971	213	107	320
Western	263	...	...	...	...
Total	$12,332	$6,813	$2,379	$1,716	$2,537

* Estimated.

Dividends Flying to New Record

Domestic carriers are expected to pay over $12 million to stockholders this year, twice what they paid in '51.

The airline industry will establish a new record in cash disbursements to stockholders this year. The domestic airlines are expected to pay more than $12.3 million to their shareholders, almost double the $6.8 million distributed during 1950.

The current year has not only seen larger airline dividends, but the greatest number of carriers making disbursements.

For 1951, 12 airlines paid dividends compared to ten for 1950, eight for 1949 and only four for 1948.

▶ **New Faces**—Joining the ranks this year were National and Western, each paying two separate dividends of 25 cents per share to their stockholders. For National this represents the first cash disbursements in its history. Western's 1951 payments are the first since 1936 when 25 cents per share was paid.

Likely to draw blanks this year are the shareholders of Capital, Colonial and TWA. Capital is expected to fulfill the technical requirements of the restrictions surrounding its surplus account and resume dividends in 1952. These will be the first since 1945 when 25 cents per share, or a total of $119,000, was paid.

The tangled finances of Colonial preclude any cash distributions in the immediate future. Colonial now has the unique position of being the only so-called truckline failing to pay a cash dividend throughout its entire corporate history. TWA, bound by technical restrictions and the need for substantial cash requirements, is unlikely to make any cash payments soon. The only payment by TWA was in 1936 when 25 cents a share was paid.

▶ **Five-Year Record**—The accompanying table reveals the record of all cash dividend payments made by the domestic trunklines for the past five years, including 1951. Results for this year are partly estimated. Dividends on preferred stock are included with the payments on the common shares of the separate carriers.

American and United are expected to account for about 67% of the group's cash disbursements to stockholders this year. Both carriers have preferred shares outstanding.

• **American's** 400,000 shares of 3½% preferred stock account for an annual disbursement of $1.4 million.

The recent declaration by American of a 25-cent dividend brings to 50 cents per common share its 1951 payments thus far. This raises to $3,267,000 the carrier's 1951 payments on its common.

• **United's** 93,000 shares of 4½% of preferred represents an annual dividend outlay of about $418,500. Only 75 cents per share has been paid on the common thus far this year. The management, however, is known to favor a liberal dividend policy, and current earnings can readily support another 75-cent disbursement this year despite heavy capital requirements for 1952.

• **Northwest's** dividend payments during 1951 are represented completely by those made on its preference shares. After lapsing on these payments earlier this year, the company paid all arrears and has restored the shares to a current basis.

• **Eastern** has followed a deliberate policy of building up the equity position of its shareholders by "plowing back" the bulk of current earnings. As a result dividends to shareholders are modest in relation to available earnings. For 1951, a 25-cent payment in addition to the 25 cents per share already paid, is anticipated.

▶ **Demands on Earnings**—With current traffic levels leading to sustained and higher earnings, the airline group would ordinarily be expected to increase its cash distributions to shareholders. This expectation, however, may be mitigated somewhat by the heavy capital requirements necessary to support the extensive aircraft acquisition programs of the carriers.

While bank credits, other financing and depreciation throw-offs will supply the bulk of the funds needed for expansion, substantial demands will be made on retained earnings. This requirement will have to be balanced with management's desire to afford stockholders with an immediate return on the investment.

Irregular and limited dividends have been characteristic of the air transport industry in the past. The constant expansion of the air carriers necessitated almost continuous reinvestment of earnings. Airline equities have not, in the past, found their principal appeal through the immediate income they may afford. Their main attraction has been in the growth qualities and ultimate degree of financial strength achieved by the companies they represent.

This condition, while remaining a major factor as an investment consideration in the airline group, no longer has the same validity today.

The broadening interest in the industry has led to expectations for a return by stockholders. The airlines do not live in an investment vacuum of their own.

To compete for investment consideration among other industrial groups, the air carriers may be compelled to provide a similar measure of income return to stockholders.—Selig Altschul

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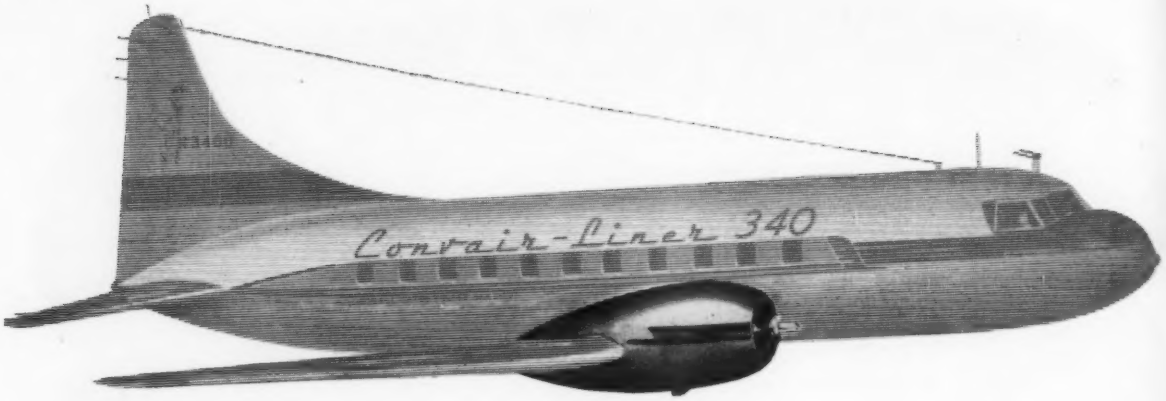

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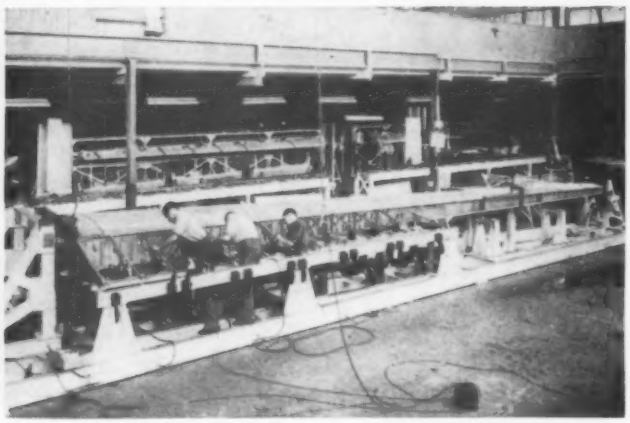
BRITAIN'S new high-wing monoplane transport, the Ambassador, is in production at Christchurch plant and there are . . .

PLENTY of Ambassadors on the assembly line, but . . .



WORKERS for the job are far too few, and so are machines.

British Productive Giant Begins to Stir

• Airplanes being built, but on small scale because labor, housing and tools are scarce.

• Techniques range from hand work to automatic machines in revival of once-flourishing industry.

By David A. Anderton

London—A trip through some of Britain's aircraft factories quickly dispels the view that she is a passive member of the NATO production team.

There is no question but what the current production effort is small when judged on U. S. standards, but there are reasons why that is so. Aside from the fact that Britain is a small country, she is still very much in the process of recovery from six years of war. Labor is short in the industry; housing is short in factory areas. Tools are needed for production of the new breed of airplanes. Wages are not so attractive as in U. S.

In spite of all this, airplanes are being built. In dozens of small factories all over the face of England, parts for Meteors, Vampires, Shackletons, Attackers and Sea Hawks are being turned out.

And there are indications of a renaissance in aircraft production.

The new Swift, the Valiant and the Hawker P.1067—representing the finest types of aircraft extant—are about to become production items instead of one-off prototypes.

And the people in the factories and offices are eager to get on with the job.

► **Further Background**—During the week following the Farnborough display, I visited four typical British aircraft factories to get background data on methods, employment, factory size. On the itinerary were:

• **Airspeed division** of the de Havilland Aircraft Co. Ltd. at Christchurch.

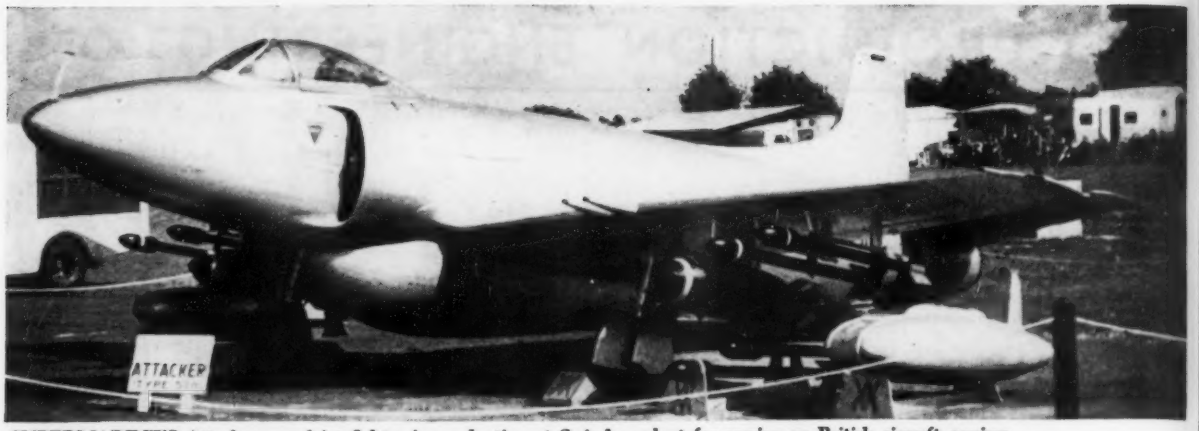
• **Supermarine division** of Vickers-Armstrongs Ltd. at South Marston, Swindon.

• **The de Havilland Aircraft Co. Ltd.** at Hatfield.

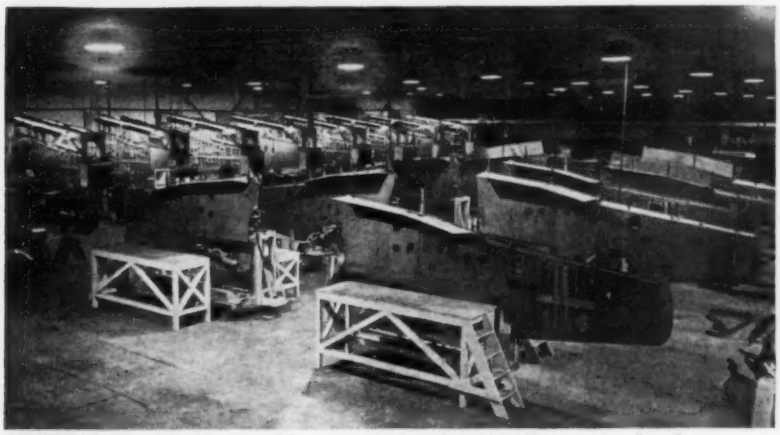
• **The Bristol Aeroplane Co. Ltd.** at Filton.

This seemed to be a fair cross-section of the industry, because it included manufacturers of military and civil aircraft and engines. The products of these four factories include helicopters, piston and gas-turbine engines, and aircraft powered by piston and gas-turbine engines, and aircraft powered by piston, jet and turboprop engines.

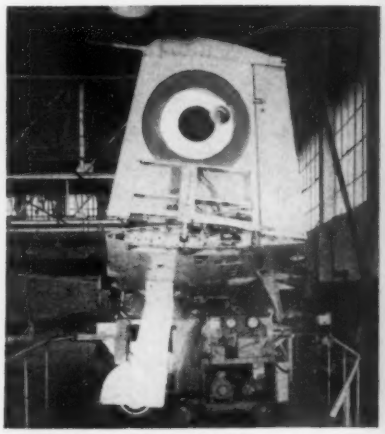
Size of the plants varied from the three smallish buildings and 1,000 employes of the Airspeed division to the



SUPERMARINE'S Attacker, naval jet fighter in production at Swindon plant for service on British aircraft carriers.



GENERAL view of wing assembly area at plant where Attackers are produced.



NOVEL test jig for checking wings.

sprawling layout of Bristol and its 16,000 workers.

And manufacturing techniques ran the gamut from hand work to completely automatic machine methods.

Most of these visits were entirely too short. So these observations necessarily are short. But from them, certain conclusions can be drawn.

Airspeed Division

The three main buildings of the Airspeed division stand at the edge of a grassy plain at Christchurch, a little resort town on the south coast of England. In these bucolic surroundings, about 1,000 employes of the division are turning out the last dozen or so of the 20 Ambassador transports on order for British European Airways.

• **The Ambassador**—more properly called Elizabethan, class name given the aircraft by BEA—is a high-wing monoplane transport for medium-length stage distances. It is powered by two Bristol Centaurus 661 piston engines, each giving 2,600 bhp for takeoff. Passenger capacity is 40 to 47, depending on interior arrangement. Maximum gross weight is 52,500 lb. Wingspan is 115 ft. At a cruising speed of 240 mph, the Elizabethans will carry 11,650 lb. of payload a stage distance of 350 mi., or 8,000 lb. for 1,000 mi.

Airspeed seems like a very small factory by American standards; and by further comparison with our own places, is a model of neatness.

From the flower-beds of rose trees set into the front lawn to the spotless apron between hangars and grass airstrip, the entire plant reflects the excellent housekeeping so characteristic of British factories.

One reason for the appearance of Airspeed's plant is its age—the buildings were finished in 1941. The plant was used as one of the shadow factories during the war. It produced Airspeed Horsa troop-carrying gliders and Oxford trainers, as well as de Havilland's great Mosquito.

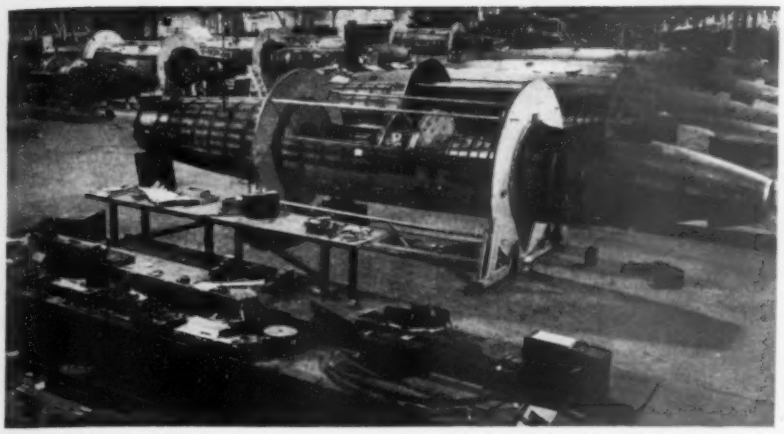
But these were all wooden aircraft—and Airspeed's current problem is all-metal. The Ambassador-Elizabethan is the first all-metal craft to be produced by the division, and as such, it presented many new problems. I got the impression that this is one reason for the continued delays in the Ambassador program.

► **Easy Does It**—A walk through the production area translates some of the idyllic surroundings into the plant. The pace is slower than in the United States; a semi-finished fuselage in the jigs will have only three persons working in it. There are other jigs containing components which have been fastened in place ready for assembly—but absolutely nobody is working on them. A rivet gun fires and the noise is shattering in the relative quiet of the factory floor. You get the feeling that it's really lunch time or after hours, and most of the staff is somewhere else.

This is not to say that the workman at Airspeed loafs on the job. It's just that there aren't many workmen. It was possible to walk all through the plant, crawling into partially complete fuselages, edging along catwalks over wing-fuselage attachment fixtures, and still not interfere with a single workman.

When the Ambassadors are through assembly and internal fitting is completed, they are flown off the 1,500-yd. grass strip which roughly parallels the plant. For full-load testing, however, flights are made from the airport at nearby Hurn.

At the conclusion of the Elizabethan



REVOLVING jig is used for fuselage work after main components are assembled.

FINAL assembly shop at Swindon, shown in this general view, is similar to those in U. S.

contract, Airspeed will have built a total of 23 planes. The first two, powered by Bristol 630 engines, were prototypes; the third was a production prototype, and the remaining 20 are the production order for BEA.

▸**After the Ambassador**—Before production of the Elizabethan stops at Christchurch, Airspeed will be setting up to build the de Havilland Vampire trainer and Venom night-fighter. In the case of the trainer, it will be back to wood work for the division, because the nose section of that craft—and of the basic Vampire from which it was developed—is of wood veneer-sandwich construction.

In this work, as in the case of the Ambassador, the Christchurch plant will be fed components from Airspeed's satellite plant at Portsmouth. Currently, the Portsmouth factory supplies wing and tail sections for the Ambassador.

Supermarine Division

The central factory of Vickers-Armstrongs Supermarine division is at South Marston, near Swindon, Wilts, in southern England. Here, Supermarine is producing the Attacker, naval jet fighter now going into squadron service on board HMS Eagle.

• **The Attacker** is a single-place, low-wing metal monoplane designed for naval use as a fighter. It is powered by a Rolls-Royce Nene 3 turbojet rated at 5,000 lb. sea level static thrust. Span of the tapered, unswept wing is just short of 37 ft. Gross weight is 11,750 lb. normally, and 14,055 lb. with a 300-gal. jettisonable fuel tank.

Backing up the Swindon plant are other dispersed factories at Southampton, Trowbridge and Newbury.

The Swindon works dates back to 1941, when it was built as a shadow factory for production of the Miles Master trainer. Some of the top personnel at Swindon today came from the Miles organization of wartime.

One building is set up as an assembly area for the Attackers, and houses two lines of aircraft, facing each other in a crowded room. A tangle of air lines and power cables criss-crosses the floor; there seem to be workmen everywhere. The noise of air-driven drills and rivet guns emphasizes the fact that this is one of the busier production plants in Britain.

Some indication of the amount of

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labor required to produce Attackers was given AVIATION WEEK at Swindon. These figures are based on a rate of 4 complete airframes per month, which is probably somewhat below the current production figures:

- 2,000 workers for sheet metal and machined parts and minor subassemblies.
- 1,500 workers for major subassemblies.
- 750 workers for wing assembly.
- 750 workers for fuselage assembly.
- 1,000 workers for final assembly.

This is a total of 6,000 productive workers, and presumably includes those in Supermarine's satellite plants which supply Swindon with components.

Off to one side of the assembly area is a wing test jig, a rather novel piece of equipment. Supermarine has found this to be a convenient pre-assembly device for checking out the many services located in the aircraft wings.

The complete wing assembly with landing gear installed is suspended in a test fixture, and connected to a test bench with hydraulic and electrical power supplies. It is possible to check out retraction, locking, unlocking and extension of the landing gear and flaps, as well as to prove out the wing folding system. And of course, landing and marker lights can be checked visually.

This is all done before the wing section moves into final assembly for fitting to a fuselage. If any faults are found later in a pre-flight check of systems, they can be traced with a minimum of effort to the correct fuselage location.

► **Small Production**—In spite of the crowded appearance of the factory and the bustle of activity everywhere, Swindon's production is fairly small. When the total number of Attackers currently on order is completed, the plant will have produced only 190 complete airframes, including those marked for export to the Royal Pakistan Navy.

Expansion is possible at Swindon. Even though the assembly bay is crowded, other sections of the factory were almost deserted. In one building, where detail parts and canopies were being made, a large floor area was completely bare. This, it developed, was being saved for machine tools currently on order from the United States.

One deterrent to expansion would be the labor supply, tight all through the aircraft industry. In order to hold many of their present staff, Supermarine has gone into the transportation business and runs bus lines on certain routes within a 15-mi. radius.

To get more workers into the area would mean that more housing would have to be built in the vicinity. And housing, which is scarce all over Britain, is more of a problem in the Swindon area. That region was neither blitzed during the war, nor is it now classified as a development area. As a result, it has no priority claim for new houses.

Even in the jet era, when aircraft are built in a fussier manner, the Swindon people are not worried about a skilled labor shortage—it's just a labor shortage. During the late war, for example, they ran the factory with only 10% of the workers classified as skilled. Right now, the figure is 50%, which means that Supermarine has an excellent foundation of skilled labor on which to build the superstructure of unskilled help that would come with determined expansion.

And of course, there are fewer women workers now—the figure is 15% as compared to nearly 60% in wartime.

► **Incentive Scheme**—Work processes at Swindon have been thoroughly time-studied and an incentive scheme based on those studies is in operation. Incentive pay is provided for work done over and above prescribed schedule. Such a procedure is still a rarity in England, but is gaining acceptance in the industry. This may be because the aircraft business is on an industry-wide bargaining basis which sets the wage pattern for the entire country. (Variations are permitted in recognizing the fact that it costs a workman more to live in a city than in a rural area, for example.)

Consequently, there is no possibility of attracting a labor supply by offering

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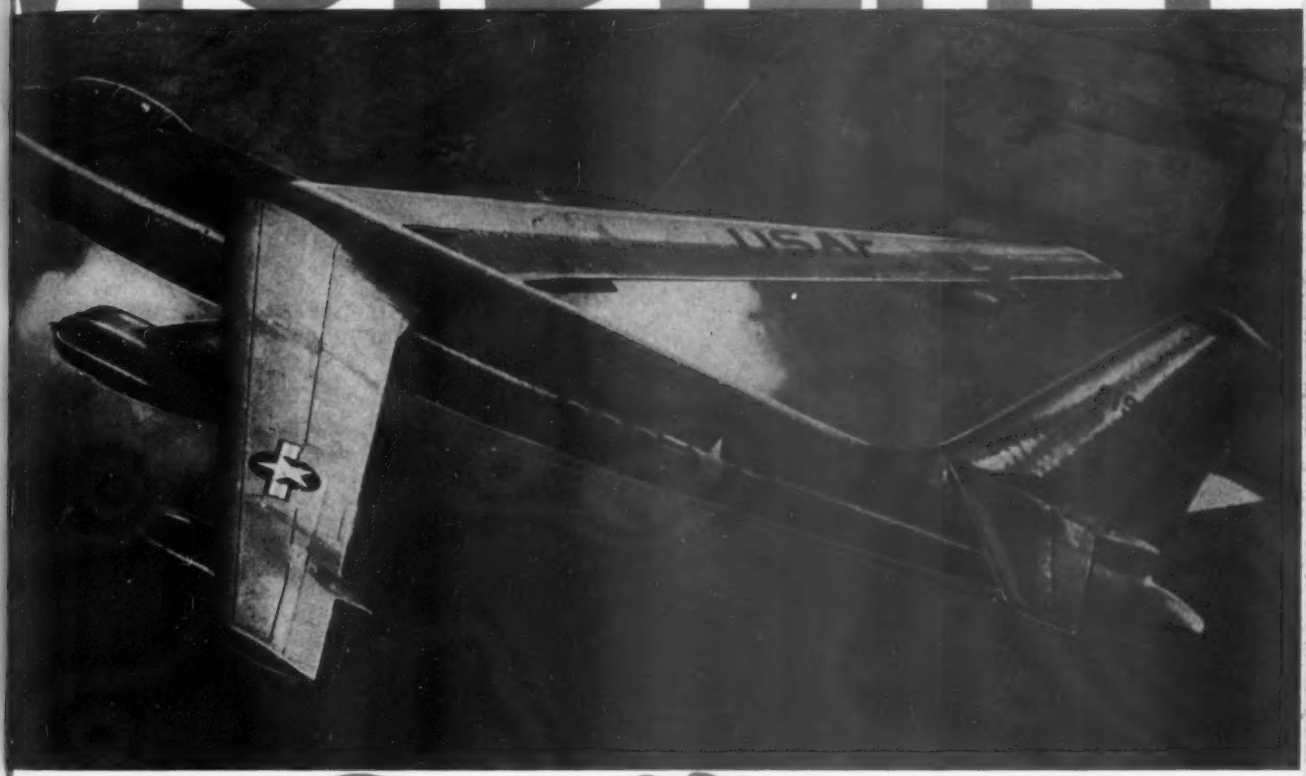

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The BOEING B-47 stratojet is the fastest known bomber in the world. This great six-jet engine powered, swept-wing bomber will be produced in quantity for the U.S. Air Force by Boeing Airplane Company, Wichita, Kansas, the Douglas Aircraft Co., Tulsa, Oklahoma and the Lockheed Aircraft Corp., Marietta, Georgia.

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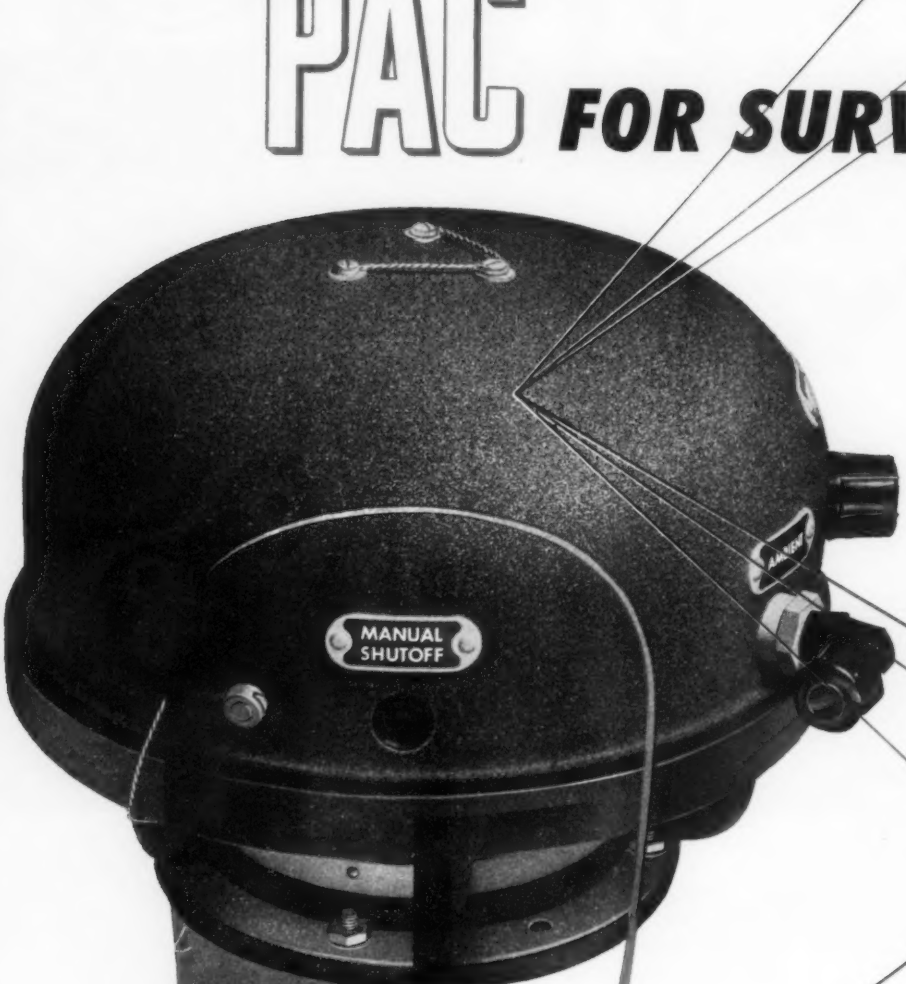

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more salary than is paid elsewhere. But the incentive scheme may be of some help in countering this drawback to recruiting.

Swindon is expected to produce Swifts, the RAF's new production fighter which was developed from the basic Attacker layout. The Swift has swept wings and is powered by a Rolls-Royce Avon turbojet. But in spite of the much-publicized statement that the RAF had ordered this fighter "off the drawing board," Supermarine management did not—at the time of my visit—have even a letter of intent to cover production of the Swift.

This could be because the RAF does not order aircraft at all—that is a function of the Ministry of Supply. The RAF could have asked the MoS to order the craft while it was still on the boards, but lots of paperwork still has to intervene between order and production.

▶**American Comparison**—All during my visit at Swindon, I had the feeling that it was most like Grumman's plant at Bethpage. There are parallels—both plants are producing an elderly, basically sound jet fighter for naval use; both plants are of about the same age, and general design.

Even the planes—Attacker and Panther—are similar, being straight-winged, turbojet-powered and a standard type of naval aircraft. Both firms have a long tradition of fine aircraft and high wartime production behind them.

Many of the Swindon staff have an "American" attitude about aircraft production—they feel that more and more airplanes have to be built faster and faster. And they have been quick to bypass tradition when it creates a bottleneck, something that other British factories could learn to advantage.

So Supermarine's star is in the ascendancy—and as the Swift gets into full-scale production, Swindon and satellites are going to be one group of the three or four most important aircraft producers in the world. And I got the reassuring feeling that they are equipped to handle the job.

U. S. Mission Orders Italian Tools

(*McGraw-Hill World News*)

Rome—As part of a program to ease the shortage of critical machine tools in the U. S., a mission of Wright Aeronautical Corp. and Curtiss-Wright technicians has negotiated initial orders for some $1.5-million worth of Italian tools for use by the American aviation industry.

The mission is dealing with the Union of Italian Machine Tools Constructors (CCIMA).

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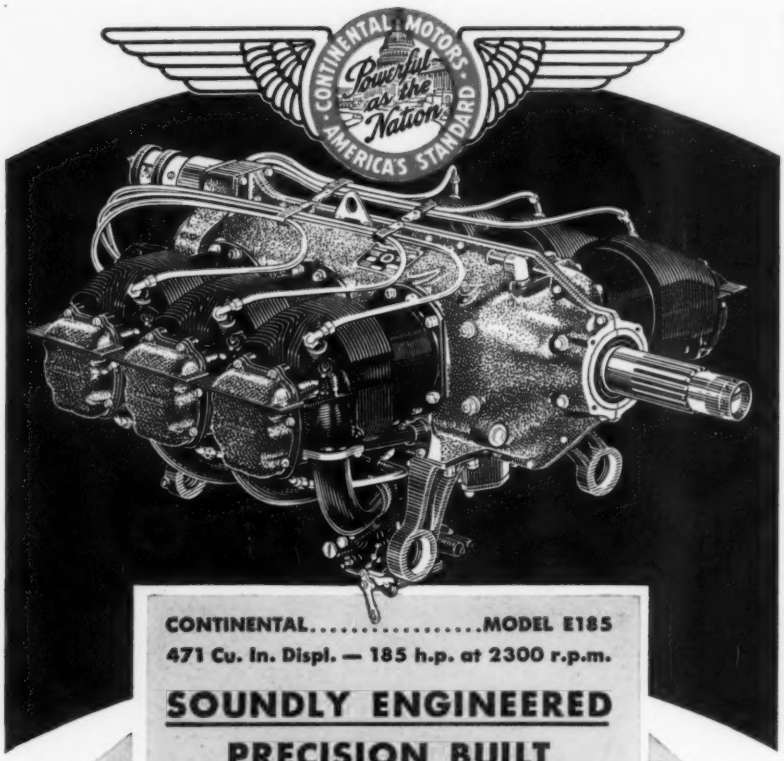

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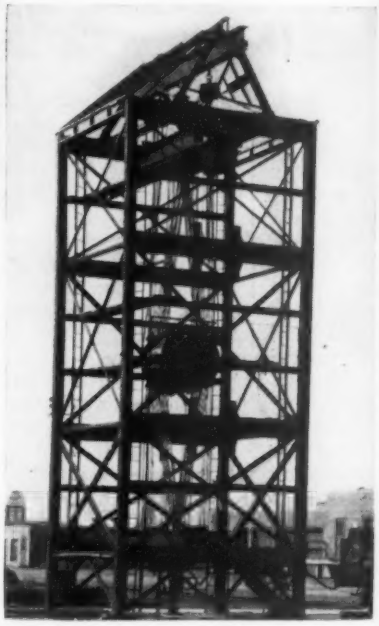
Plotter for Graphs

An automatic plotter that spots 40 points per minute on graph paper operates from digital data furnished by IBM cards or by a keyboard.

Known as the Teleplotter, the unit uses digital electric counters and photoelectric reading head which counts the graph paper's lines and spaces in perpendicular directions.

Developer of the device—Telecomputing Corp., Burbank, Calif.—says that the photoelectric scanning is direction sensitive and gives plotting accuracy independent of paper stretch and ruling accuracy.

Linear or logarithmic graph paper may be used, five scale factors are available for each axis, and five symbols permit as many curves to be plotted on the same paper.



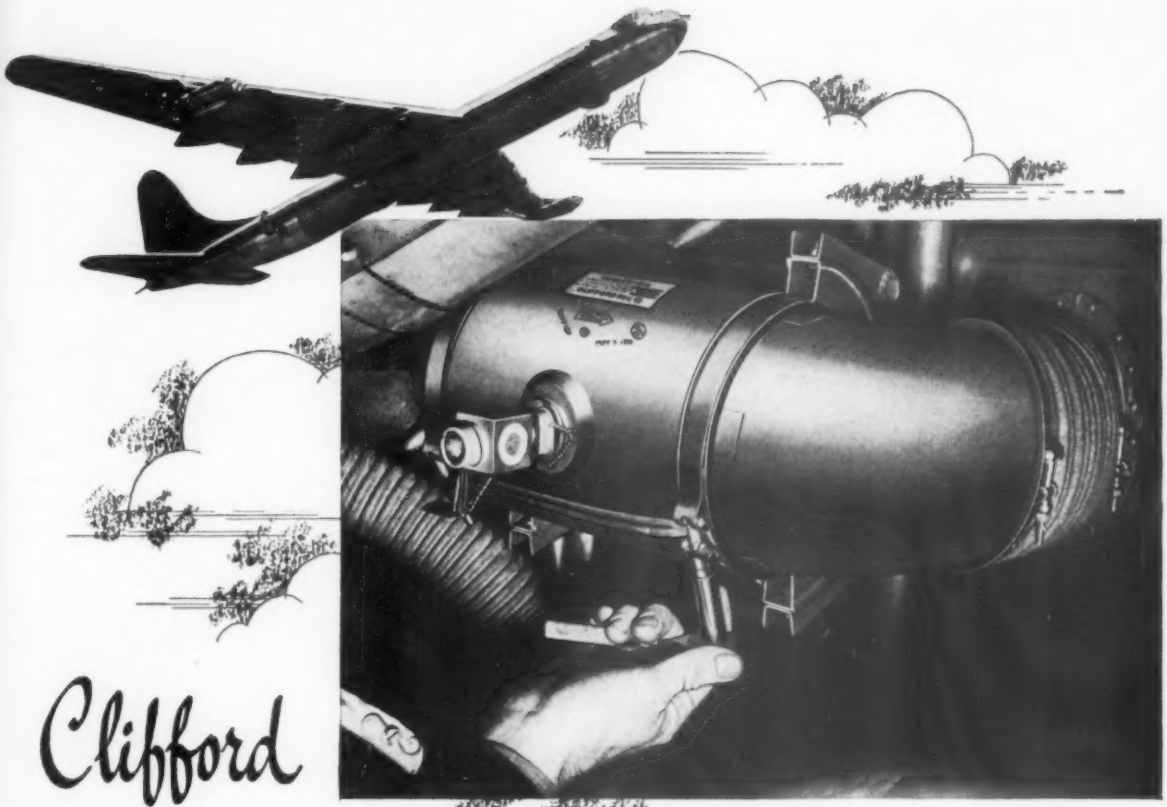
Tower Tests Effect Of Supersonic Flight

A preview of the effects of vibration and oscillation on aircraft components in supersonic flight will be obtained with a new test tower recently completed at Bell Aircraft Corp.

The rig will handle parts weighing up to 3,000 lb. and will be capable of introducing vibrations ranging from 5 ft. to a few inches with a frequency from 1 to 15 cps.

► **Piston Power**—The 40-ft.-high and 15-ft.-square steel tower is supported on a 4-ft.-thick concrete base. The component under test is suspended by shock cords attached to two nitrogen-driven piston furnishing the power.

One of these pistons is anchored to the base of the tower, while the other is



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WORLD'S LARGEST BOMBER, the Convair B-36D, has a 10,000 mile range and a ceiling of over 45,000 feet.

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suspended from a crossbeam at the top. A Bell-built timer regulates the cycling valves controlling the frequency and stroke of the pistons. An oil system operated by differential gas pressure supplies lubrication to moving parts during vibration operations.

▶ **Tank Studies First**—First test project will be the study of vibration effects on various types of aircraft and missile tanks. A pump system will permit volume and rate measurement of liquids extracted from the tank during the test, to record effects of this withdrawal.

Design and development of the tower was piloted by Bell engineers Herb Mund and Dick Payne with the cooperation of Jay MacFarland of the project group. Structural details were completed by plant engineering's Clyde Freiert.

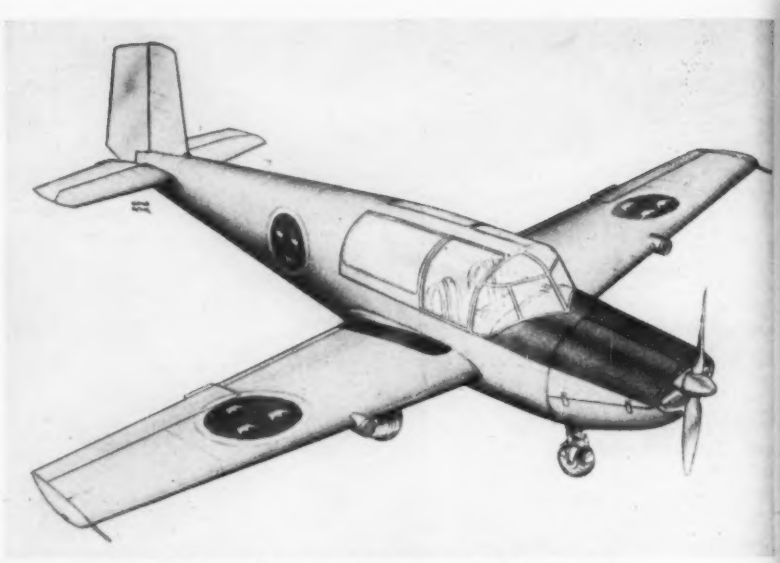
British Open Contest For Copter Studies

An annual prize of £25 ($70) is being offered by the Helicopter Association of Great Britain for the best technical paper on any subject connected with rotary-wing aircraft. The paper will be known as the Cierva Memorial Prize Essay in honor of Senor Don Juan de la Cierva and his pioneering work in the field of rotary-wing flight.

Entries must be original, not previously submitted to any other body and not previouly published. Copyright of the winning papers becomes the property of the association and no papers will be returned.

Competitors need not be association members, and they may be of any nationality.

- **Subject:** Studies in the field of aeronautical science and engineering, or in operations, administration, maintenance, navigation, safety or economics of rotary-wing craft. Purely historical or journalistic aspects will not be eligible.
- **Language:** English preferably, but French and German are acceptable.
- **Length:** Recommended not to exceed 5,000 words.
- **Style:** Three typed copies; manuscript entries will not be considered. All diagrams or figures must be drawn in indelible ink and either submitted in triplicate or drawn on tracing paper for reproduction.
- **Deadline:** Entries for 1951/1952 must be received by Mar. 31, 1952.
- **Age limit:** Competitors must be under 35 years of age on Dec. 31, 1951. Date of birth must be stated. Competitors must be prepared to furnish proof of birth date if requested to do so.
- **Address:** Helicopter Association of Great Britain, Londonderry House, 19 Park Lane, London, W. 1, England.



SAFIR TRAINER is shown above in artist's drawing and below in flight.

New Swedish Air Force Trainer

More powerful version of Safir has 190 hp. Lycoming engine, boasts top speed of 171 mph., seats three.

The Royal Swedish Air Force gets a new trainer—the Saab-91 B, a newer, more-powerful, three-seat version of the Safir—but it's not to be built at home. Instead, the production order goes via subcontract, from the Saab Aircraft Co., the parent firm, to the Dutch shipbuilders De Schelde, which also operates an aircraft factory at Dordrecht near Rotterdam.

The new craft is designated Sk 50 by the Swedish Air Force, and is intended to replace the Buecker Bestmann (Sk 25). Because of other current military commitments, the plane could not be built in Sweden.

▶ **Born from Experience**—The original Safir version has had about five years' experience and operations all over the world. It has been used as a trainer for the Netherlands Government Civil Flying School and by the Imperial Ethiopian Air Force.

The 91 B differs from the Safir in having a more powerful engine. The original version carried the de Havilland 145-hp. Gipsy Major 10; the 91 B has a 190-hp. Lycoming 0-435-A flat six. The results are higher speed, faster climb and a higher service ceiling. Increased tankage of the new model has increased the range.

A Hartzell variable-pitch propeller is fitted. Other improvements include a new heating and ventilating system, improved instruments with dual flight instrument panels, dual brakes and throttles and enlarged cabin windows for improved aft vision. Cabin hoods are jettisonable.

Wingspan of the 91 B is 34 ft. 9 in.; length, 25 ft. 9 in.; height, 7 ft. 2 in. Wing area is 146 sq. ft. Gross weight is 2,565 lb.; empty weight is 1,580.

Maximum speed is 171 mph., sea level rate of climb is 1,140 fpm.

Convair pioneers 1st atomic plane!

It's no longer just theory. Convair's exceptional engineering talents will be employed to harness *atomic power* to aircraft *performance!* The U. S. Air Force has awarded Convair the contract to develop America's first atomic-powered airplane, and General Electric—working jointly with Convair—will develop its nuclear propulsion system. The job will be done...adding another first to the already impressive list of Convair's achievements in designing aircraft of the future. This contract is still another tribute to Convair research-engineering-production teams...and to the far-sighted corporate management which makes A-plane development possible!

ENGINEERING TO THE "Nth" POWER...literally! The Air Force, Atomic Energy Commission, Convair and General Electric are working closely together to advance America's defense program. Always the goal at Convair is: the projection of power to achieve the *maximum degree* of performance. The maximum, the Nth degree of air power...*the Nth Power—Atomic Power!*

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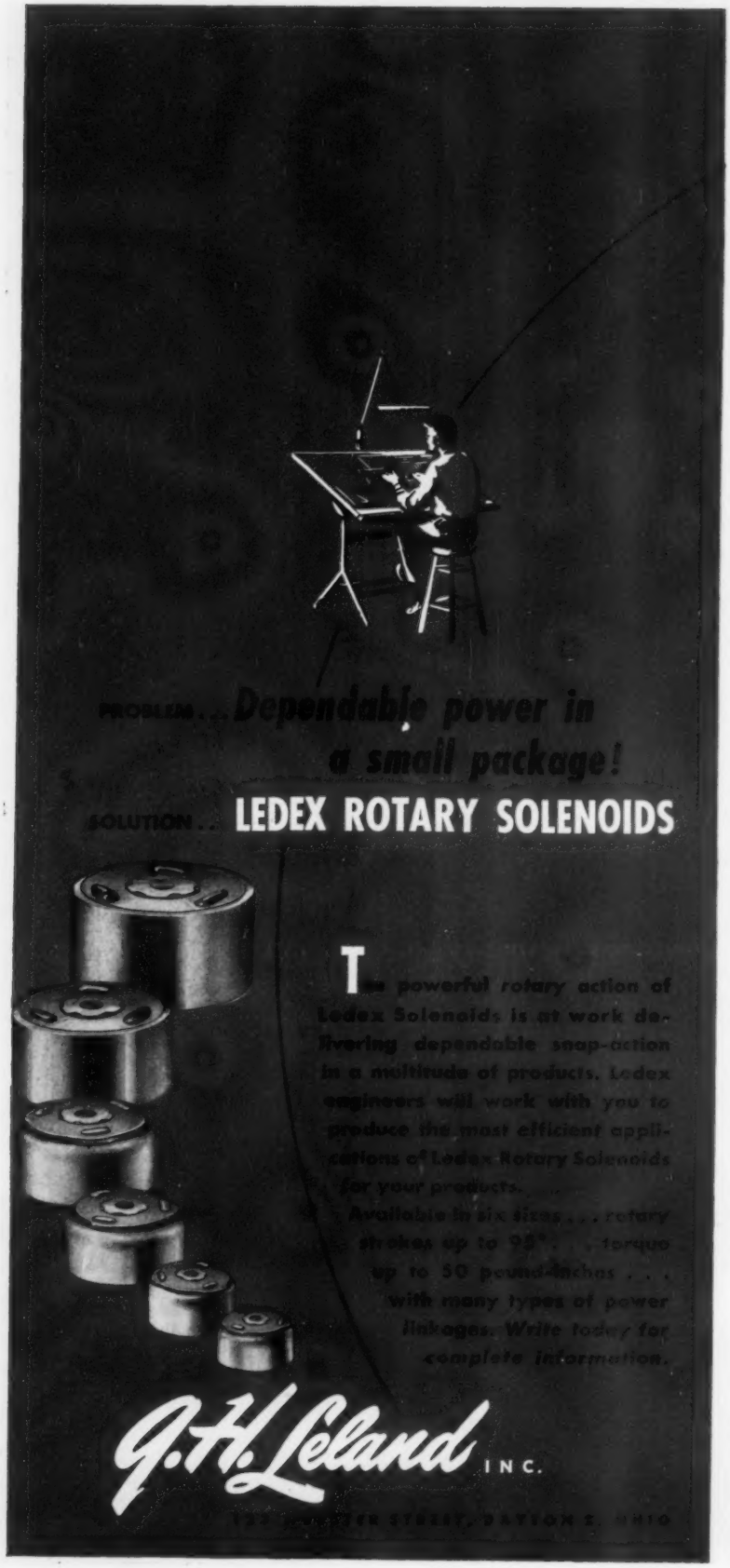
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Available in six sizes . . . rotary strokes up to 95° . . . torque up to 50 pound-inches . . . with many types of power linkages. Write today for complete information.
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Long Line

Ford Aircraft Engine division is building a 2¼-mi. long monorail conveyor system in its 4.3-million sq. ft. main assembly plant at Chicago for mass production of Pratt & Whitney R-4360-53, R-4360-59 and R-4360-63 engines. The $2-million conveyor network is scheduled to be completed in November. It will include 184 hoists and bridge cranes, 4,500 ft. of bridge crane runways, 130 vertical assembly dollies and 80 horizontal dollies.

Assembly plan calls for breakdown of the engines into six major divisions: power section, cylinder, nose, miscellaneous, supercharger, and dress. Power conveyor main lines will be used for the green assembly, tear-down and final assembly lines. Assemblies will be fed into the main assembly lines by six major assembly carriers, and similarly six major parts carriers will transport the disassembled parts from the teardown line for inspection and minor rework before final assembly.

Electronic Scale Records Weights

One of the latest applications of electronics is in the field of weighing.

An electronic scale and recorder that will weigh objects with great accuracy and record or print the information at any remote location, has been placed on the market by the Streeter-Amet Co., Chicago.

The compact unit is made up of a Baldwin-Lima-Hamilton load cell, whose primary component is a Wheatstone bridge, and the necessary instrumentation to convert the electrical output of the cell to mechanical energy for the electronic scale's recorder.

►**How It Works**—Deflection due to load causes a voltage change in the Wheatstone bridge. Resistors compensate for temperature changes which might affect the readings.

Cells are designed to operate at 120% of capacity and loads up to 150% should cause no damage except, perhaps, a shift in the zero position which may easily be reset.

The current passes through an amplifier to a servo balancing motor which rotates a precision potentiometer until the system is in balance again. The motor also drives the recording apparatus. (This circuit is phase sensitive and when pressure on the load cell is

The unsurpassed safety, dependability and wearability of Thompson *Extra-Landings* Retreads have been proved by nearly 100,000 airplane tires retreaded by Thompson. They provide far more landings and less frequent wheel changes. Each tread is built with precision workmanship and each tire is balanced perfectly.

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VAPOR AIRCRAFT TEMPERATURE CONTROLS

OFFER A "DEAD BEAT" WITH NO OVERSHOOT!

The stabilization time of Vapor Controls was such that if a temperature change of 100° was obtained manually in two seconds, the control under identical conditions would only require two seconds to reach and stabilize at this new temperature; i.e., the control would dead beat for practically every control point change with no overshoot.

Featuring a linear (dead) band adjustable from zero to infinite, Vapor Controls are accurate and have a decided advantage over converging band controls. Voltage variations of from 105 to 125 volts do not change the characteristics of Vapor Controls.

An important point brought out during the aircraft engineering conference was that all agreed that Vapor Controls had infinite versatility and maximum potentials for use. For details write . . .

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SAN FRANCISCO • JACKSONVILLE • RICHMOND • HOUSTON • MONTREAL • LOS ANGELES

removed, the motor reverses, bringing potentiometer back to original position.)

The recording apparatus is made up of a series of step cams which convert rotational information from the motor to digital information on the printer.

Another cam actuates a stamp which is forced against the tape and type wheel, printing data desired on a card, ledger sheet, tape or other medium.

Glass Textile Firm Buys Tape Concern

Hess, Goldsmith & Co., Inc., a major supplier of broad glass fabric to the aircraft, electrical, plastics and other industries, and a prime and subcontractor to the USAF, Navy and Army, has taken a major step into the narrow industrial type field by purchasing the assets of Horace Linton & Bro., Inc., Philadelphia.

The new acquisition will operate as the Horace Linton division and its former president, Wallace R. Linton, has been appointed vice-president and general manager. Sales responsibility has been assumed by Raymond F. Clark, vice-president-sales for Hess, Goldsmith.

Broad glass fabrics are goods over 24 inches wide and are used in fabrication of radomes, honeycomb structural components and numerous other applications. Narrow industrial tapes run up to approximately 1¼ inches wide, are widely used in electrical insulation.

How To Be Cleared

"How to be Cleared for Handling Classified Military information Within Industry" is a new booklet aimed at prospective military business bidders or contractors, explaining in question and answer form how clearances are made and what they cover. The booklet, costing ten cents, is available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D. C.

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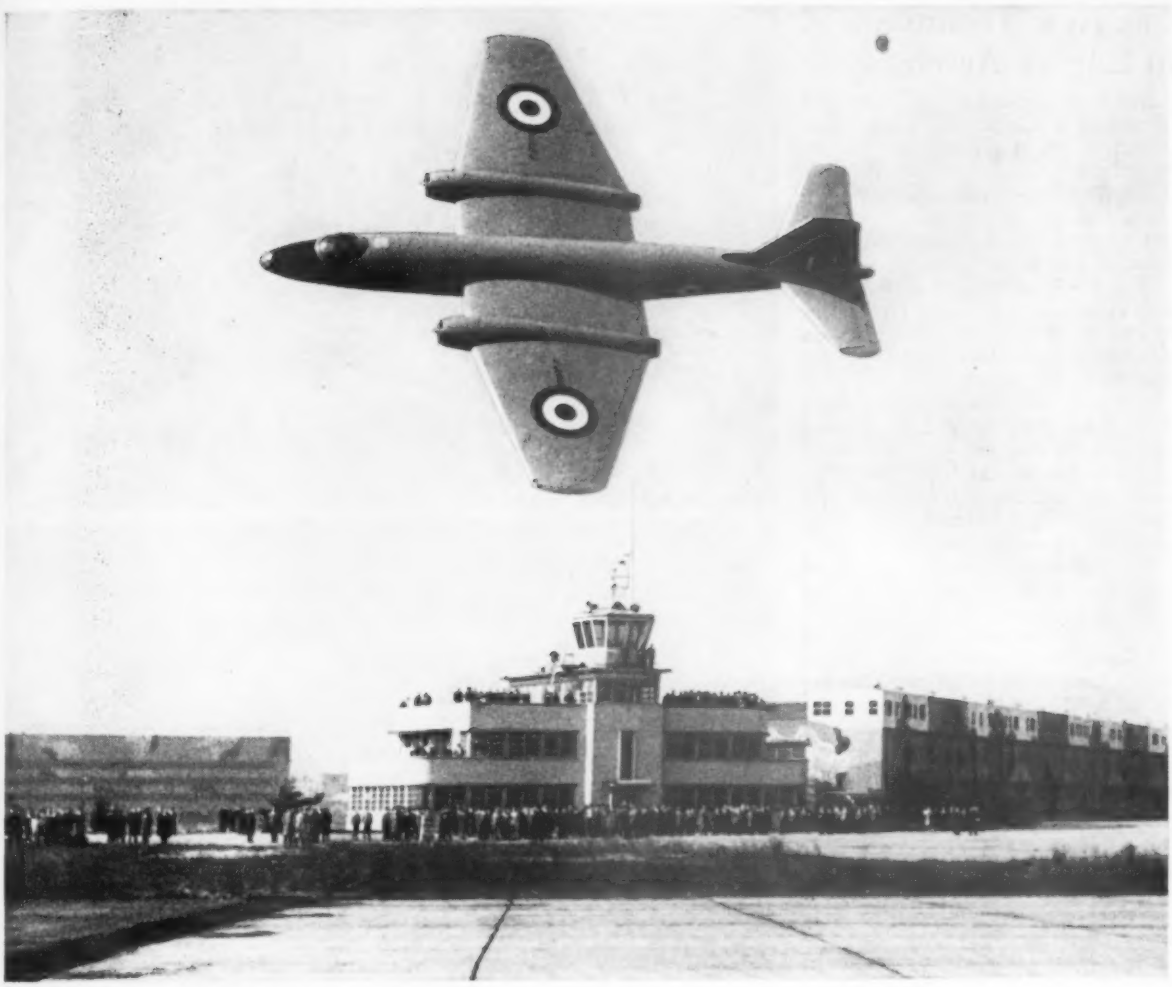

Above, the Canberra demonstrates its amazing all-level maneuverability on arrival at the Martin airport.

Below, the record-setting crew of the Canberra, R. H. T. Rylands, radio operator, Wing Commander Roland P. Beamont, pilot, D. A. Watson, navigator.

Wings to Shrink the World mean insomnia for the enemy. The tireless speed that flashed the twin-jet Canberra light bomber across the Atlantic in record-setting time of 4 hours and 19 minutes—the zooming loop and blurring roll that signaled its arrival at the Martin airport—these foretell the tactical effectiveness of the night intruder version of the Canberra being developed by Martin for the United States Air Force.

Combining this fighter-like speed and maneuverability of the basic design by the English Electric Co., Ltd., with the advanced armament, electronic and engineering of the Air Force-Martin team, the B-57A reflects the growing potency of our tactical air power — assuring that enemy troops will neither rest nor move safely under cover of darkness.

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THE GLENN L. MARTIN COMPANY, Baltimore 3, Md.

Use New Technique in Engine Assembly

Assembly line techniques at Wright Aeronautical Corp. are being engineered to speed put-together of the J-65.

Engine parts will converge on a series of lift-and-pit installations, each of which will be a fixed site for the vertical assembly of a single powerplant.

The circular floor-pit is about 12 ft. deep and houses a hydraulic lift, decked by a steel platform. Onto this platform is rolled a steel dolly on which the wheels may be locked.

With the dolly deck positioned about 1 ft. above floor level, the assembly operation begins at the nose, each successive component being added towards the tail. As the assembly progresses, the lift is lowered to keep the work at a convenient height.

► **For Convenience**—This method of vertical assembly is more convenient than the horizontal approach, say Wright Aero engineers, particularly for the installation of rotor and turbine wheels, and is better adapted for the jet engine's length.

When the engine is built up, it will be rolled off the line on its dolly and placed in a special rotating rig that facilitates installation of test equipment. It is rolled to the cell block in this same rig.

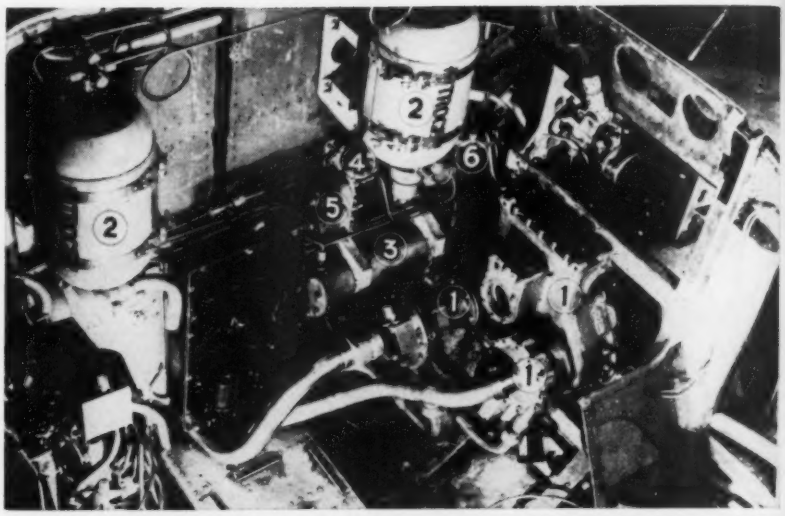
At a recent showing of one of the pre-mass production J-65s being put together for a tooling and assembly stand check, it was noted that the center section was made of steel. In the British counterpart—the Sapphire—this part is aluminum alloy. This change undoubtedly was incorporated for additional strength.

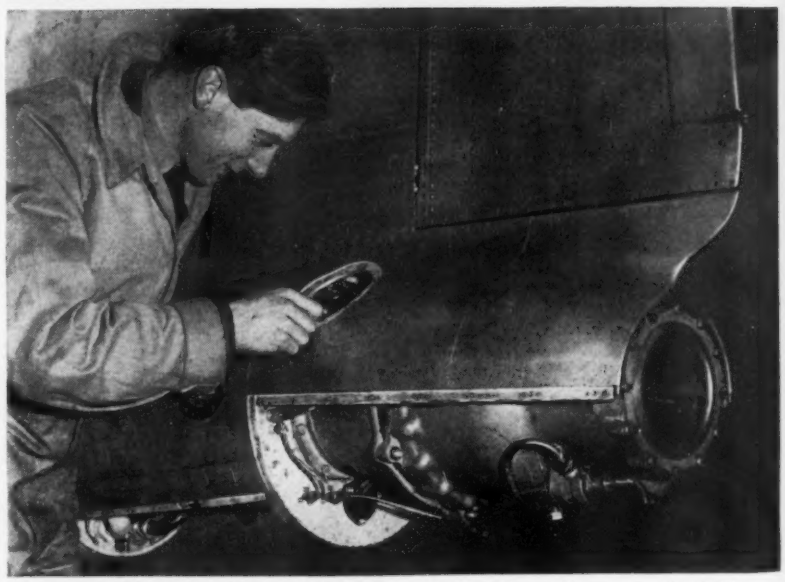
Also different from the British engine will be the J-65's auxiliary power-takeoff requirements and form of these takeoffs, and some accessory pads are being relocated.

► **Fuel Delivery**—A view into the aft end of the engine as it was poised on the lowered vertical lift showed the annular combustion chamber with its pattern of closely spaced vaporizing tubes for fuel delivery. These point upstream, directing the vaporized fuel to the ignition area.

With its 13-stage rotor, the J-65 probably will have the highest compression ratio of any single-stage compression jet.

Company engineers, in collaboration with a firm of sound control specialists, also have devised an efficient muffling system for its jet test cells. Inlets are fitted with a combination of sound-absorbing panels and tuned chambers (as in NACA's Cleveland lab), and Maxim silencer units are used for jet exhausts.





ROCKET MOTOR, fits into tail of jet fighter and provides auxiliary power in flight.

Details of British Snarler Revealed

Latest propulsion unit to come off Britain's secrecy list is Armstrong Siddeley's Snarler—an auxiliary rocket motor intended to boost a jet fighter's push at takeoff, in climb and in high-altitude flight (AVIATION WEEK Sept. 24, p. 221).

This is Britain's first "hot"-type rocket, using liquid oxygen and water-methanol for fuel, as distinguished from the "cold"-type de Havilland Sprite, which uses hydrogen peroxide and a catalyst for fuel.

The Snarler develops 2,000 lb. thrust at sea level, weighs 215 lb. dry, and will fit a space of 3 x 6 ft. Reports are that at about 50,000 ft., its thrust will increase approximately 12%.

It has been flight-fired in extensive trials with the Hawker P.1072 experimental fighter (the P.1072 was converted from the original P.1040, prototype Seahawk.)

The motor, of course, has on-off control, and endurance is reported to be about three minutes at full thrust. Main components break down into three categories—the main-engine-driven pump gearbox, the valve system, and the combustion chamber. The chamber is cooled by the water-methanol solution before the latter is mixed with the liquid oxygen for combustion.

The top photo, showing equipment details of the Snarler in the P.1072, reveals (1) accessory gearbox and pumps; (2) nitrogen bottles; (3) air filter and dryer; (4) nitrogen reducing valve; (5) pressure-operated switches; (6) solenoid-operated air valve.

Connector Problem?

...We'll take it from HERE

Good ideas for electronic circuitry sometimes run afoul of connector problems. Maybe existing connector units won't hold air pressure gradients, won't stand the heat, aren't rugged enough for the job. Or maybe it's a question of altitude, or under-water application. But if you can sketch the circuit, we'll take it from there. We've engineered so many special connectors, solved so many "impossible" problems, that whatever the requirements are, we can usually provide the answer.

Lightweight actuators for any requirement.

Job engineered, welded-diaphragm bellows.

Flexible conduit and ignition assemblies.

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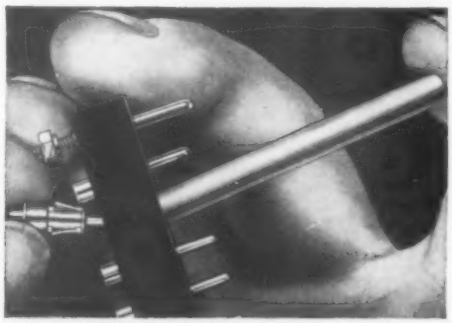

Removable pins in Breeze connectors speed soldering, save time, trouble. Pins snap back into block.

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Standard-Thomson Tech-Forge bellows make the ideal flexible coupling for practically every aircraft use—exhaust, cabin heating, de-icing systems, etc. Forged and fabricated by an exclusive process, stainless steel Tech-Forge bellows can be furnished in sizes from ¾" to 36" I.D. In any size, the Tech-Forge process assures minimum thinning of the fabricated metal, so that comparatively light-gage metals can be used to advantage, without loss of strength. For full engineering details, or recommended specifications, write:

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Thompson Extends Its Avionics Outlook

Thompson Products has added a unit to its recently formed Electronics division, with purchase of Antenna Research Laboratory, Columbus, Ohio.

With the purchase, the Cleveland manufacturer moves into the rapidly expanding microwave antenna field and acquires a group of engineers who are expected to become the nucleus of a growing division. Robert Jacques, who headed Antenna Research Lab, has been named chief engineer of the Electronics division by A. L. Pomeroy, acting manager.

Until now, the division has had as its only product the coaxial switch formally announced a year ago.

Production of the microwave antenna will be in Tapco's main plant at Cleveland with the newly acquired Columbus laboratory and leased machine shop there retained for research and development work as well as some preproduction work.

▶ **Dummy Load**—In addition to acquiring the microwave antenna Tapco also secured ownership of an electronic device used in the field by military radar operators to absorb the power that would normally be transmitted by the radar set through its antenna, and so far known as the "dummy load."

In practice the "dummy load" replaces the antenna for test purposes. If it were not used, hostile radar operators would be able to locate our radar during calibration procedure. The energy put out by the radar is dissipated into the "dummy load."

In addition to the military market, Tapco sees almost unlimited peacetime commercial possibilities, especially with the advent of ultra high frequency TV. Its new UHF antenna, considerably smaller than existing devices serving home TV sets, is of a design more critical with regard to electronic performance and will do a better job on both black and white and color TV.

Tucson 'Sells' Self To Electronics Firm

The city of Tucson, Ariz., has found it pays to offer inducements to industrialists. By agreeing to construct water and sewer lines, a railroad spur, and offering other assistance, the city persuaded the Hughes Co. to build a multimillion dollar electronics plant in Tucson.

The initial plant development will be about $9 million.

The Tucson Airport Authority, which dealt with the Hughes Co., agreed to do $459,000 worth of work in order to acquire the plant.

Continuous Belt Circuit Baker

A small continuous-belt furnace, designed primarily for firing limited production runs of printed circuitry, has been designed and constructed at the National Bureau of Standards.

So far the furnace has proven highly useful in the Bureau's laboratory. Firing capacity is fully adequate to the needs, even though seven batch-type furnaces previously used proved frequently inadequate.

Floor space requirements of the unit are 26 by 54 in.

▶**Printing Fluid**—A silver paint is used at NBS for printing the circuits. This fluid consists of finely powdered metallic silver, an organic vehicle and solvent, and a flux. The circuit pattern is printed on ceramic or glass plate by a stenciled screen process and the plate is fired.

Firing drives off the vehicle and solvent, activates the flux and causes partial sintering of the silver particles; the result is a firmly bonded metallic film of high conductivity.

Operation of the furnace is simple. A continuously moving horizontal metal belt carries the material to be fired into the furnace at one end and delivers the finished product at the other.

Generally, printed plates are fired at 1350F and spend a little over an hour from cold input to cold output.

Plates are stacked six deep on the belt, which is four inches wide. At the usual belt rate, 800 sq. in. of plates can be fired in one hour.

Temperature of the furnace can be controlled thermostatically to within 7 deg. up to 2000F.

Feed rate of the belt can be controlled through changes in the speed-reducing train of gears, belts and cone pulleys. Firing cycles can be adjusted from 25 to 265 min.

Highspeed Machine Hobs Gears Faster

A highspeed gear hobber "employing new principles for faster hob-generating of accurate gears and splines" has been announced by Michigan Tool Co., Detroit, Mich.

While maximum speed utilization may have to await development of suitable carbide hobs, the machine already cuts steel gears at rates approaching "carbide" speeds, says the firm. In only 58 sec., for example, it will produce two helical gears having 22 teeth, (3¼ in. dia., two-in. total face width, 9 pitch gears).

Intended to produce virtually all sizes of gears manufactured in high production, this horizontal single-spindle ma-

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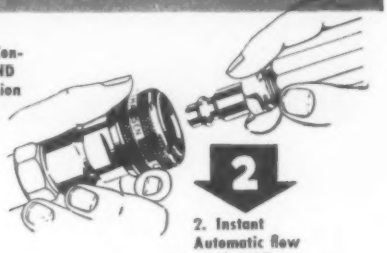

2. Instant Automatic flow or Shut-Off

Locking pins in Hansen Push-Tite Coupling Socket afford large area contact with plug, thereby preventing wear and subsequent leakage.

● With Hansen couplings you save precious minutes every time you change air tools—every time you connect or disconnect a fluid line carrying gas, liquid or grease.

● To connect, you merely push plug into socket—flow starts immediately. To disconnect, pull back sleeve on socket—coupling disconnects. Flow is shut off instantly and automatically.

One-way shut-off, two-way shut-off, and straight-through types. Write for catalog giving complete listing of sizes and types.

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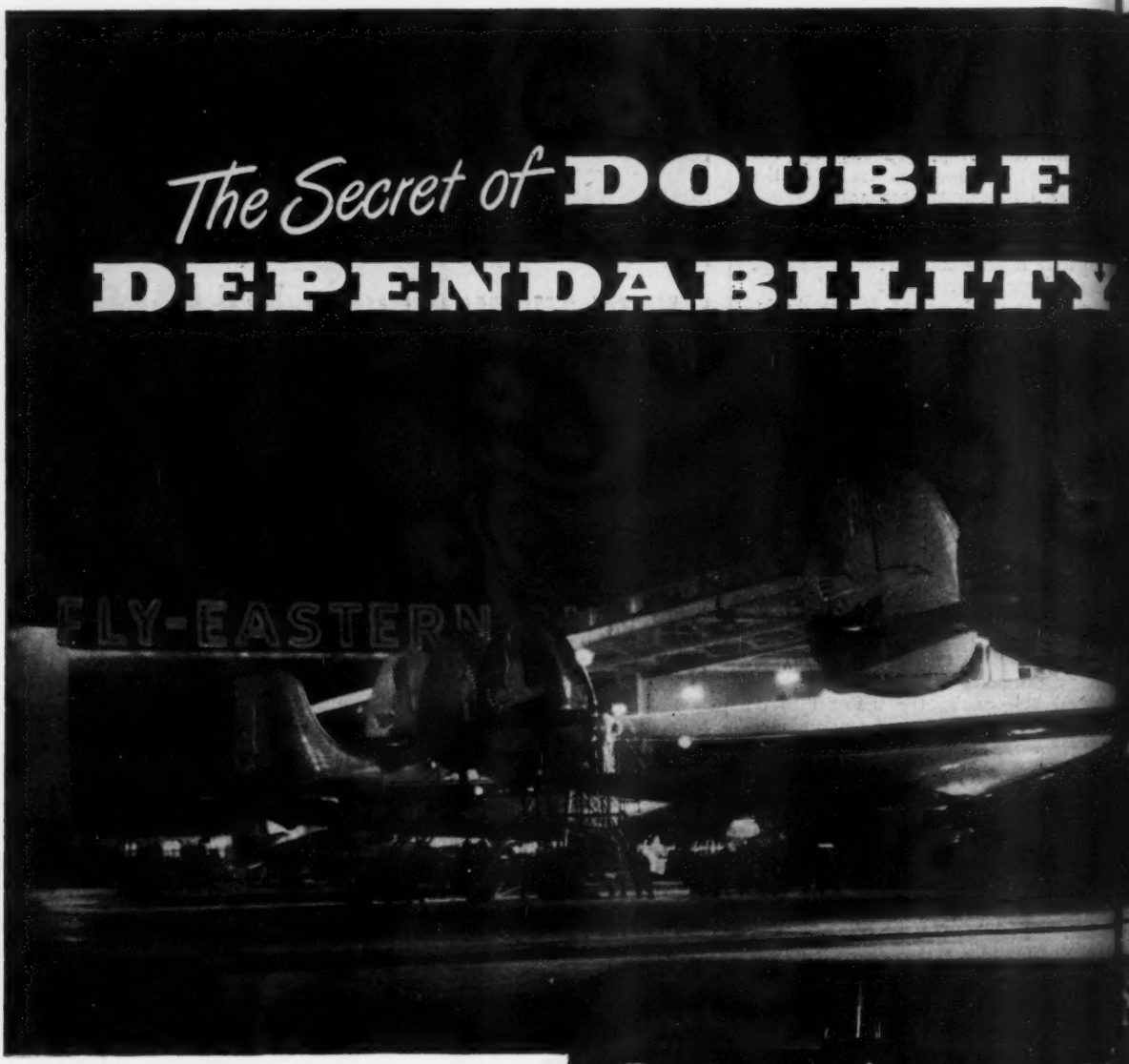
The Secret of DOUBLE DEPENDABILITY

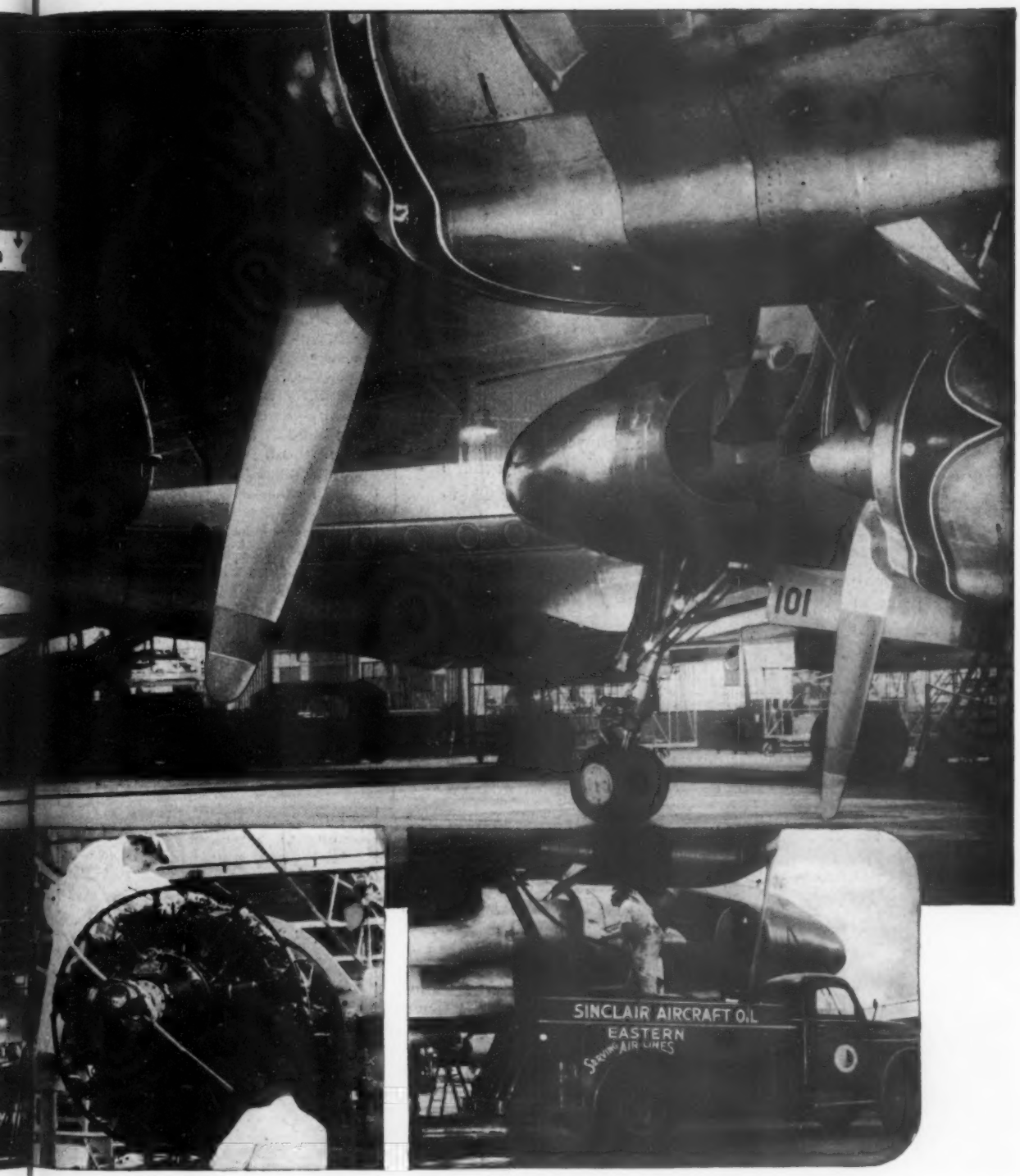


Everywhere in Eastern Air Lines' great maintenance base one sees concrete signs of its deep concern for safe, dependable air travel. Every operation is performed, every decision is made, with this principle in mind.

It is doubly significant, therefore, that Eastern has selected Sinclair to handle its vital lubrication needs.

Plane Taking Its Physical. Eastern's Miami base—one of the world's largest, most complete maintenance centers. About once a week, every airliner returns here for a major examination.

SINCLAIR



They Double Check — for double dependability. On each major engine overhaul Eastern expends some 500 man-hours—many more hours than standard requirements. Many of the tests and checks made are exclusive with Eastern, too.

Eastern Takes No Chances with engine lubrication, either. Only Sinclair Aircraft Oil is used in the Great Silver Fleet. Sinclair lubricants reduce costs, provide fine, safe aircraft engine lubrication.

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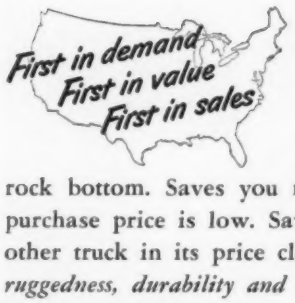

Whatever the job you have for a truck, Chevrolet has the truck that's *right* for your job! It's a new Chevrolet Advance-Design truck, built to cut your trucking costs down to rock bottom. Saves you money when you buy, because the purchase price is low. Saves money right along, because no other truck in its price class offers the great combination of *ruggedness, durability and economy* you get in Chevrolet. Just look at the extra value features that make Chevrolet trucks *stand up better, handle easier, cost little to run and maintain.* Your best truck deal is the deal you get on a Chevrolet Advance-Design truck at your Chevrolet dealer's.

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TWO GREAT VALVE-IN-HEAD ENGINES—the 105-h.p. Loadmaster or the 92-h.p. Thriftmaster—to give you greater power per gallon, lower cost per load • POWER-JET CARBURETOR—for smooth, quick acceleration response • DIAPHRAGM SPRING CLUTCH—for easy-action engagement • SYNCHRO-MESH TRANSMISSIONS—for fast, smooth shifting • HYPOID REAR AXLES—for dependability and long life • NEW TORQUE-ACTION BRAKES—for light-duty models • PROVED DEPENDABLE DOUBLE-ARTICULATED BRAKES—for medium-duty models • NEW TWIN-ACTION REAR BRAKES—for heavy-duty models • NEW DUAL-SHOE PARKING BRAKE—for greater holding ability on heavy-duty models • NEW CAB SEATS—for complete riding comfort • NEW VENTIPANES—for improved cab ventilation • WIDE-BASE WHEELS—for increased tire mileage • BALL-TYPE STEERING—for easier handling • UNIT-DESIGNED BODIES—for greater load protection • ADVANCE-DESIGN STYLING—for increased comfort and modern appearance.

chine will handle any helical or spur gear or spline up to 8 in. dia. and 4¾ in. face width.

Operation is said to be extremely simple; one man can operate two or more machines with ease. Setup is rapid and changeover for a gear of different helix takes only about 20 min., the firm says. Construction permits manual or automatic loading and hob shifting (push-button control). Hobbing can be climb or conventional.

The hobber is designed to cut gears automatically at hob spindle speeds up to 1000 rpm. (equivalent to 1300 sfpm. for a 5-in. dia. hob); at feeds up to ¼ in. per hob thread per revolution of work. According to Michigan, accuracy appears to be dependent on tools rather than on machine conditions. All rotating parts are precisely fitted. Rigidity has been provided not only in the structural elements, but in the operating units. The new tool is said to be notably smooth and lacking in vibration. Drive simplication has been accomplished through use of positive dual hydraulic feeds. Torsional deflection is reduced to a minimum by use of greatly oversize gears and shafts.

This new addition to the defense lineup, requires floor space of 84 x 84 in. Over-all height, including hob-shifter, is about eight ft. Weight is 21,000 lb.

Our Expanding Industry . . .

Ryan Aeronautical Co., San Diego, has established a ceramic coating development agency to coordinate experimental work in adapting titanium to airplane exhaust systems. Now in production of stainless steel ceramic coated exhaust systems for airliners, Ryan also is conducting experimental work on jet engine components as well as on other exhaust systems, including those for Army tanks.

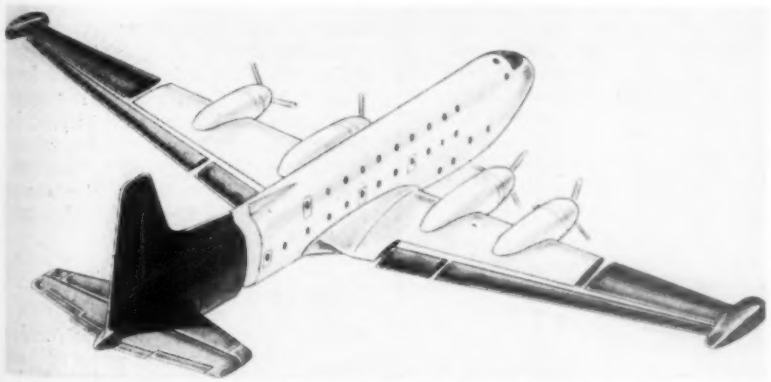
Modglin Co., Inc., Los Angeles, is in production at its new $500,000 metal products division, with firm orders and letters of intent from Northrop and Convair for tool engineering and manufacturing and production of aircraft sub-assemblies.

Aluminum Goods Mfg. Co., Manitowoc, Wis., a leading manufacturer of cooking utensils, is producing parts for F-84 Thunderjet fighters and will expand facilities for increased defense work. Company produced wide range of aircraft components during World War II.

General Electric's major appliance division expects to be in production of jet engine parts at Louisville, Ky., by next spring. Some members of the department have arrived in Louisville to set up for operations. Eventually entire major appliance division will be moved from Bridgeport, Conn., to new Louisville offices.

Sprague Engineering & Sales, Gardena, Calif., with a substantial backlog of armed forces, airline and aircraft company orders for test equipment, has been incorporated under California laws to facilitate financing. Company products include pressurized cabin leakage testers, hydraulic system testers, fuel flow test benches, jet engine accessory and high pressure test stands.

American Helicopter Co., Inc., Manhattan Beach, Calif., has opened a new 40,000 sq. ft. helicopter powerplant manufacturing and test facility at Falcon Airfield, Mesa, Ariz. Company has backlog of prime AF helicopter and pulse-jet powerplant orders.



Plymouth Division of the Chrysler Corp. is adding 800,000 sq. ft. space at its Los Angeles plant where it will fulfill a multi-million-dollar contract for Douglas C-124 Globemaster II parts (dark areas in photo). Components now are being manufactured at the Douglas Santa Monica plant. Complete change-over to Plymouth is expected during January, 1953.

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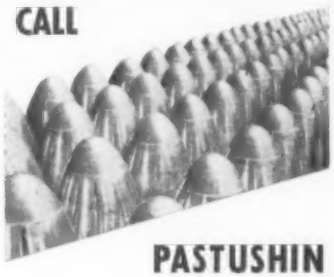

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New Ideas Spark Ignition Conference

Spark Plug Service Experience*

Airline	Aircraft	Lead Content of Fuel[1]	REMOVAL TIME (Hr.) Sched.	REMOVAL TIME (Hr.) Actual	Unsched. Removal Rate[2]	Total Life (Hr.)
R-2800 Engine; water injection; low tension ignition system; R37S-1 plug						
KLM	DC-6	3.5	240	240	1.2	1000[3]
Slick	DC-6	4.0	300	300	0	—
AAL	DC-6	3.6	400	225	1.06	800(e)
UAL	DC-6	—	—	—	—	—
Panagra[4]	DC-6	3.5	300	275	1.6	800
R-3350 Engine, R37S-1 plug						
PAA-NAD	L-049	—	275	250	7.0	(A)
Capital	L-049	—	130	125	4.3	450
Panairdo Brazil	L-049	—	400	180	8.3	256[3]
BOAC	L-049[5]	—	100	—	3.0	900(e)
TWA	L-049	—	200	—	2.1	700[3]
C&S	L-649A	—	520	254	3.0	612[3]
EAL	L-749	—	700	635	2.24	1300
BOAC	L-749[6]	—	100	—	3.3	900(e)
Air France	L-749	—	500	400	3.0	1000
	L-749[6]	—	500	400	3.0	1000
TWA	L-749	—	400	—	2.3	700
KLM	L-749	—	600	600	1.9	1800
MATS	C-121	—	200	200	—	—
R-2000 Engine (2SD 13-G), R37S-1 plug						
Faucett	DC-4	—	100	110	2.0(e)	400(e)
TACA	DC-4[6]	—	300	285	.9	1000(e)
PAA-LAD	DC-4	—	375	300(e)	.8	1000
Capital	DC-4	—	130	125	.8	450
TAL	DC-4	—	350	330	2.5	—
PAA-PAD	DC-4	—	500	450(e)	1.5	1000(e)
CPA	DC-4[7]	—	200	—	—	600
Braniff	DC-4	—	400	200	1.75	—
WAL	DC-4	—	360	240	1.2	900
NWA	DC-4	—	400	320(e)	1.27	600
NAL	DC-4	—	300	290	2.0	600
UAL	DC-4	—	300	266	.68	—
EAL	DC-4	—	400	325	1.09	650
Fly. Tiger	DC-4	—	280	118.3	9.62	500
Fly. Tiger Foreign	DC-4	—	160	—	—	500
DAL	DC-4	—	300	300	—	—
Sabena	DC-4[8]	—	175	124	1.9	520
Air France	DC-4	—	250	230	4.0	1000
Air France	DC-4[6]	—	250	230	4.0	1000
TWA	DC-4	—	400	—	1.9	700[3]
MATS	C-54	—	200	200	—	—
MATS	C-54[9]	—	200	100	—	—

** As reported at the Champion Aircraft Spark Plug and Ignition Conference by R. K. Christie, director of research, Champion Spark Plug Co.*

[1] Cubic centimeters per gallon.
[2] Per 1,000 hr. of engine operation.
[3] Average for all types of aircraft used.
[4] No water injection; high tension system.
[5] With RS192R plug.
[6] With RB19R-2 plug
[7] With RB27R plug.
[8] With RS192K plug.
[9] With LS-88 plug.
(A) Does not recondition plugs; installs new plugs upon removal.
(e) Estimated.

- **Fuel additive scavenges lead deposit, cuts fouling.**
- **KLM happy with results of not cleaning its plugs.**

By George L. Christian

Toledo, O.—Knotty aircraft ignition problems were unraveled with considerable success by industry experts at Champion Spark Plug's recent Aircraft Spark Plug and Ignition Conference here. Among the highlights:

- **Lead fouling,** long a hindrance to correct spark plug operation, was challenged from different directions by two bright new products: Shell Oil's prodigy, TCP, a potentially remarkable lead scavenger; and Champion's high energy plug, capable of firing under water through a complete coating of graphite and other spark smotherers.
- **Erosion,** responsible for limited life of countless millions of plugs, suffered a two-pronged attack: high resistance plug (test units with 10,000 ohms nominal resistance indicated erosion reductions of 50%); and new electrode alloys show promise of resisting erosion.
- **Ceramic insulators,** breakage of which is prime cause for pre-ignition and plug leakage, are being toughened still more.

Glass seals are just starting to roll down Champion's production line on the brand new R37S-1E plug to ease leakage troubles.

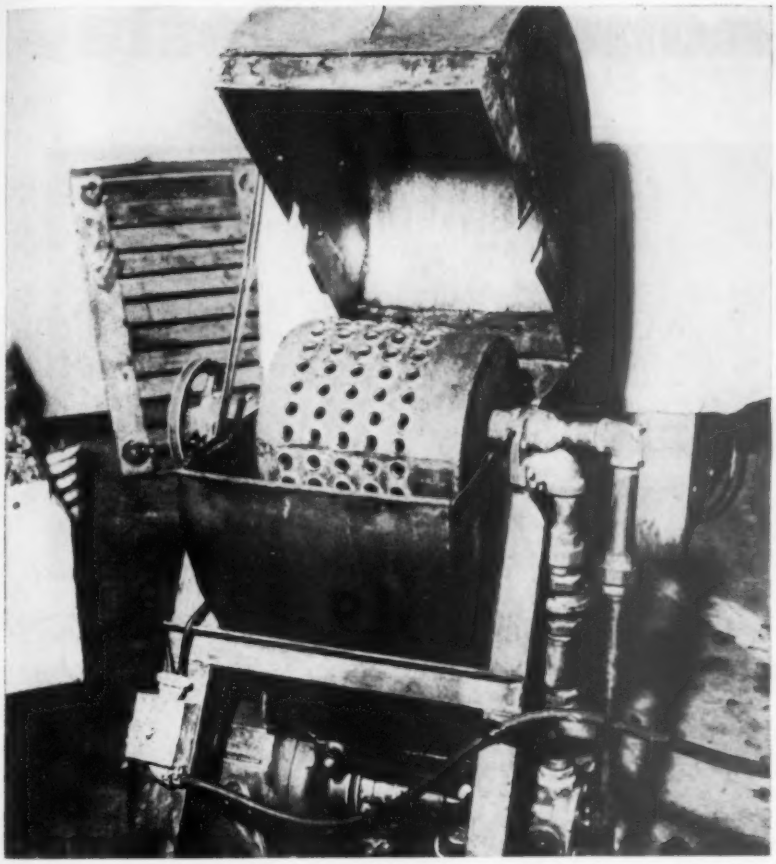
- **Low tension ignition** systems by Scintilla are rapidly engulfing the large reciprocating engine field—R-2800, R-3350, R-4360—reducing erratic behavior of ignition at high altitudes and extending plug life.
- **Engine and ignition analyzers,** long neglected twin detectives of the ignition world, are gaining wide acceptance by both military and commercial operators.

But a major topic of last year's conference, the plug with the life span of an engine overhaul, gained little attention this year.

Scavenger vs. Solvent

Shell Oil's V. E. Yust delivered a paper reviewing the mechanics of spark plug fouling and the work done by his company to track down a suitable scavenger.

Yust demonstrated that although the major constituent of the deposit on two plugs operating in a laboratory test en-



NEA'S CLEANING MACHINE carries spark plugs screwed into drum. High velocity stream of cleaning fluid squirts on firing end of plug during 270-deg. drum rotation.

gine was lead oxybromide, $2PbO{\cdot}PbBr_2$, the plug with the greater deposit operated satisfactorily, the less leaded plug was fouled up. Therefore, lead oxybromide was not directly responsible for fouling the latter plug.

Further analyses correlated the presence of metallic lead with fouling, the substance frequently being present in little beads easily visible with a magnifying glass. Continued investigation proved that the conclusions drawn in the laboratory were identically applicable to results obtained on large multicylinder aircraft engines—fouled plugs contained metallic lead in concentrations as high as 4%. Only small quantities of metallic lead are required to disturb plug operation, the substance being an excellent electrical conductor.

▶ **Fouling Causes**—Studying the mechanism by which metallic lead is formed, Shell determined that "carbon reduced lead oxybromide to metallic lead during medium to high engine output." The metallic lead, did not collect between the electrodes, causing a direct short, but reduced the shunt resistance and affected the tendency of deposits to adhere to the ceramic core, causing misfiring. Another combustion chamber material capable of reducing lead salts to metallic lead is iron.

Operating variables such as rich mixture idle, extremely lean cruise mixtures and low mixture and cylinder head temperatures exert an appreciable effect on fouling.

Metallic lead being a very stable material not easily removed from spark plugs, it became apparent that scavengers rather than solvents would be most effective. Additives were investigated which would lower metallic lead concentrations in the combustion chamber, reacting preferentially with the metallic lead residue during combustion.

Literally hundreds of spark plug fouling tests revealed that the addition of an unspecified amount of tricresylphosphate (TCP) gave these encouraging results: A test plug, which fouled on an average after four hours of operation on fuel containing a concentration of four ml/gal. of tetraethyllead with the standard ethylene dibromide scavenger, operated satisfactorily on the same fuel for 62 hr. with no evidence of fouling when TCP was used as scavenging agent.

▶ **Results**—"This represented a 1,100% increase in the time for spark plug fouling, in contrast with only a small in-

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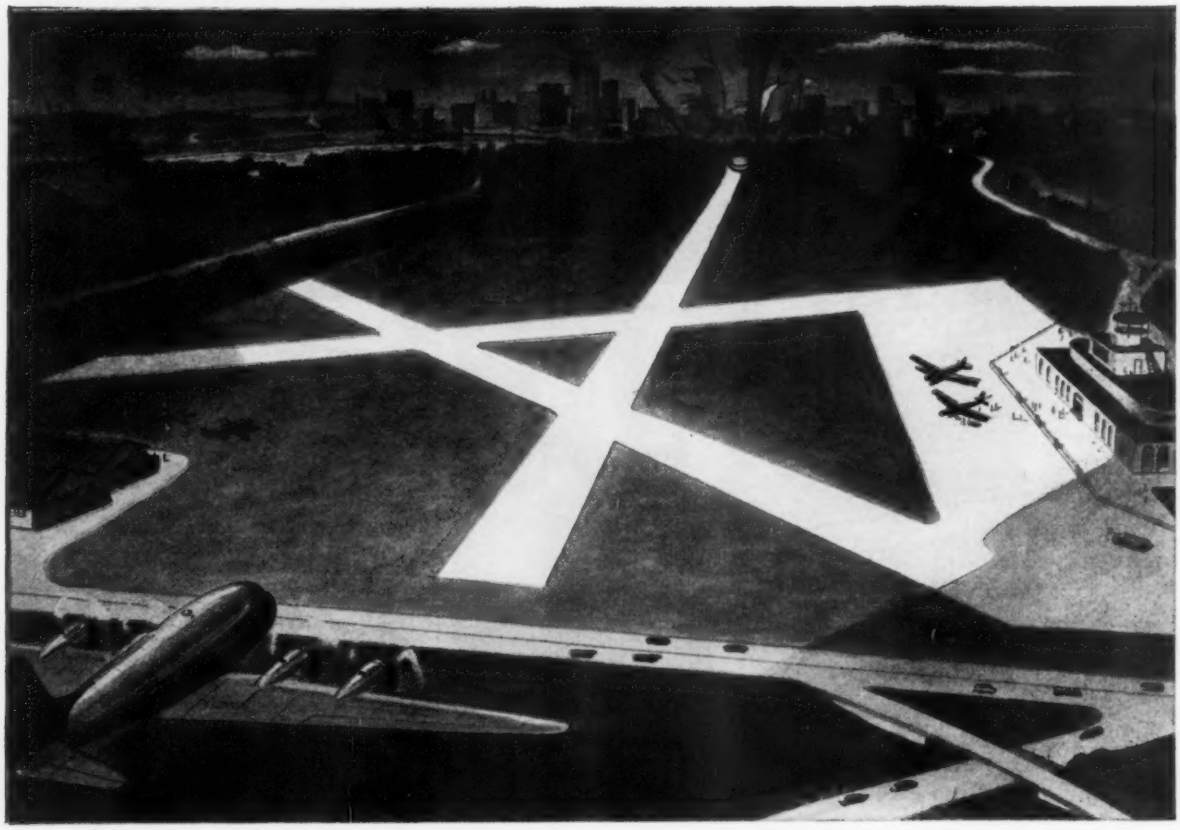

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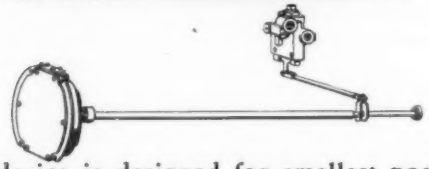

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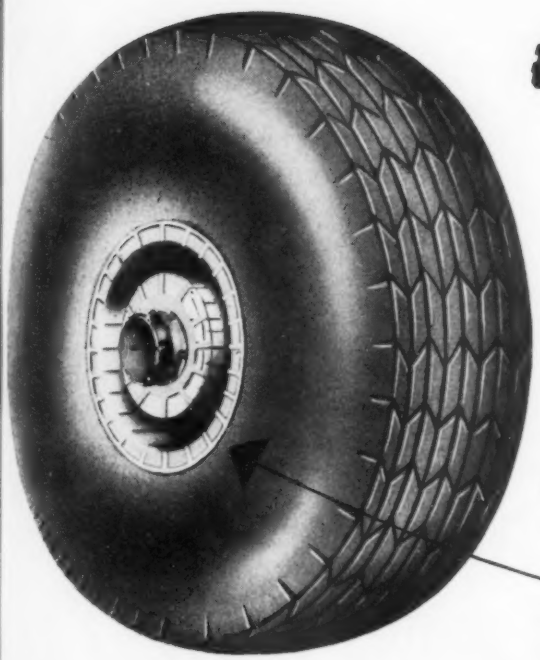

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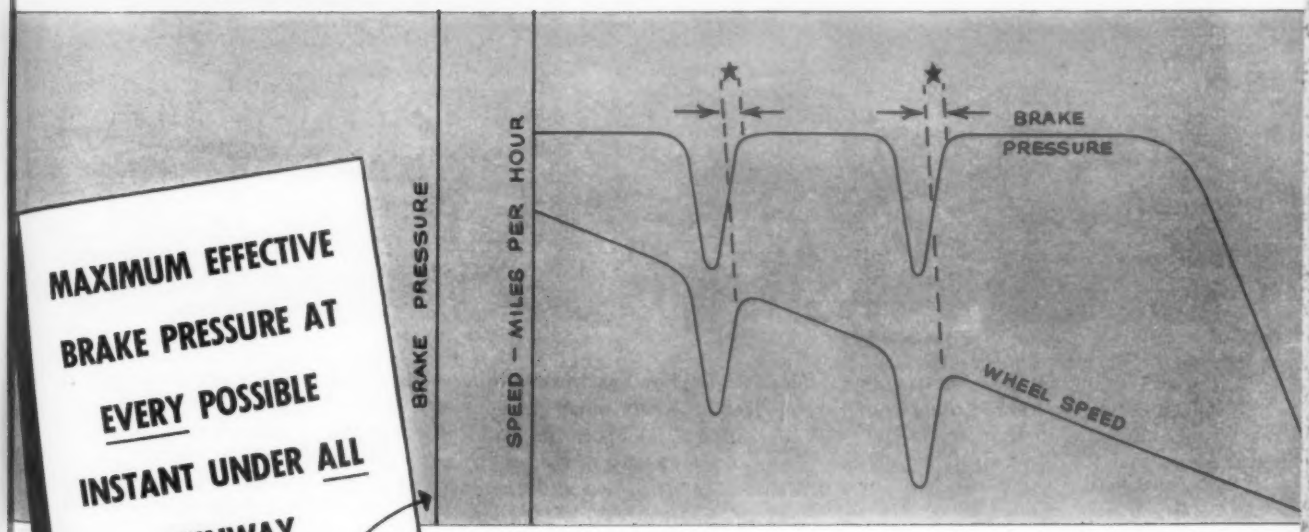

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UP THERE WITH THE BIG NAMES...CHAPTER NUMBER 8

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crease for the lower lead content or the increased halide scavenger," Yust said.

This table summarizes the results obtained by Shell:

Effects of Scavengers and Tetraethyllead on Plug Fouling Time

Scavenger	TEL, ml/gal.	PFT, hr.	% Increase
1.0 T. EDB	4.0	4 (approx.)	0
1.0 T. EDB	3.0	8 "	100
1.2 T. EDB	4.0	6 "	50
TCP	4.0	>62	>1,100

Code: EDB = ethylene dibromide
TEL = Tetraethyllead
PFT = Plug fouling time

Subsequent tests on a variety of engines revealed that TCP fuel continued its fight against fouling and no harmful effects resulted from its use. Quantity of deposits, reduced in some engines, remained essentially unchanged in others. But deposits were usually soft and powdery rather than glazed. Another advantage was substantial reduction in exhaust valve crown erosion.

▶ **Current Status**—Pratt & Whitney Aircraft conducted a 400 hr. test with TCP on an R-4360 engine, repeatedly simulating long range transport flight. Cruise part of the cycle fuel/air ratio was 0.06. Examination of the plugs at the conclusion of the test, by bomb and 17.6 engine tests "indicated that the plug performance was substantially equivalent to that obtained on reconditioned clean plugs . . . an outstanding record . . ."

The Shell scavenger is currently being flight tested. The company reports that results to date appear quite promising, but it is still too early to draw definite conclusions.

Plug Cleaning

Conclusions drawn in a paper by J. R. Griffin and J. K. Livingstone of the Organic Chemicals Dept., E. I. du Pont de Nemours & Co., on plug cleaning were that no material is yet known which will dissolve all of the deposits on aircraft spark plugs.

Hydraulic washing, using high velocity jets, is of great importance in removing deposit from the firing end of the plug, the paper stated.

Hot concentrated hydrochloric acid was the most successful chemical cleaner found. Another fairly effective compound consisted of an emulsion of:

Material	Wt. %
Concentrated Hydrochloric Acid	20
Ammonium Acetate	12.6
Orthodichlorobenzene	15
Glim	2
Water	50.4

Final results, according to the paper, demand "further development of the process and the necessary equipment will be required before chemical cleaning of the aircraft spark plug can be considered a practical reality."

No Plug Cleaning

KLM has experienced the rather startling experience of reducing premature plug removals by **not** cleaning them, according to G. Lam, its representative.

First clue leading to KLM's idea came when its personnel noticed that the nose ceramic of Champion plugs did not foul badly, possibly because the heavy, four-electrode configuration screened the ceramic sufficiently to discourage deposits built up.

Guinea-pigging on Convair's R-2800 engine, KLM started installing Champion plugs (R37S-1) and the non-cleaning procedure in November, 1950. Initially, the plugs were inspected every 100 hr.; inspection period now is up to 250 hr.

Results of the Convair tests were so encouraging, the airline extended the procedure to DC-6s and Constellations. And premature removals on all three aircraft decreased. (KLM recently has been installing BG plugs in the rear

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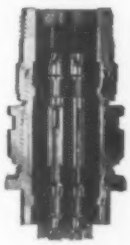

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position of both rows of its DC-6 R-2800s because of an overheating problem. For details, see below.)

► **KLM's Way**—This is the inspection procedure KLM established in conjunction with its non-cleaning practice. Champion spark plugs were washed in gasoline, the gap was reset and the plug checked in a BG tester at 420 lb. and 8,000 v. Then it was bomb-tested at 220 lb. and 18,000 v.

Plugs are kept in use until the overall width of the mass electrode is reduced by erosion and resetting to 0.23 in. (5.8 mm.).

Here are some of the results of KLM's program:

• **Convair 240**—Unscheduled spark plug removals dropped from 15 per 1,000 hr. of engine operation to 1.6.

• **Constellation**—Regapping period has been increased to 650 hr.; average plug life is 1,300-1,800 hr.

• **DC-6**—Champion plugs, used in the front position of both rows of cylinders, are changed every 370 hr. and replaced with new plugs. Removed units are shunted to other aircraft engines.

The BG plugs, newly installed in the rear positions of both rows of cylinders are removed and sand-blasted every 185 hr., according to Lam. He added that the BG installation has resulted in a sharp reduction of combustion chamber troubles—primarily fewer failures of exhaust valves and pistons. He added that the installation was too new to draw any final conclusions.

Service Experience

These are some of the highlights of this discussion.

• **New versus Used Plugs.** Trans World Airlines uses new and used plugs indiscriminately in its R-2800 CB16 engines with excellent results. It has not experienced burned valves or other combustion chamber troubles and does not anticipate any. If troubles exist, TWA does not think that the plug is the key. Part of the success TWA attributes to the well-designed engine installation in the Martin 2-0-2A and to a conservative engine operational procedure. Engine back-firing during descent from altitude was traced to too lean a mixture. Resetting the carburetor to a richer mixture licked this problem. The airline is experiencing generally excellent results with the R37S-1 plug.

• **Wider Gaps.** During the past year, airlines have switched from .011-.014 in. to the .013-.016 in. gap setting, as follows:

R-1820: C&S, NAL, CAP.
R-1830: CPA, Frontier, NEA, WAL.
R-2000: BAL, NAL, NWA, PAA-PAD-LAD, CAP.
R-2800: NAL, NEA, MCA, PAA-LAD, PANAGRA.
R-3350: PAA-NAD.
R-4360: NWA, PAA-NAD-PAD.

• **Better Performance.** Al Yacovone, P&WA engineer stated that benefits to be derived from installation of low tension ignition systems on R-4360 engines were reduced spark plug erosion and weight saving, low tension systems being lighter than high tension. He also looked for less moisture problems, better high altitude performance and the possibility of firing plugs with lower shunt resistance.

• **Hot & Eroded.** Paul Kovac of American Airlines expressed concern about the high heat and erosion rates showing up on R37S-1 plugs installed in the rear positon of Nos. 2, 4 and 6 cylinders

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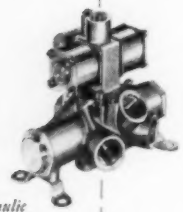

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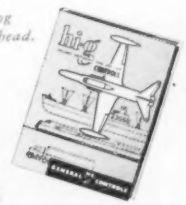

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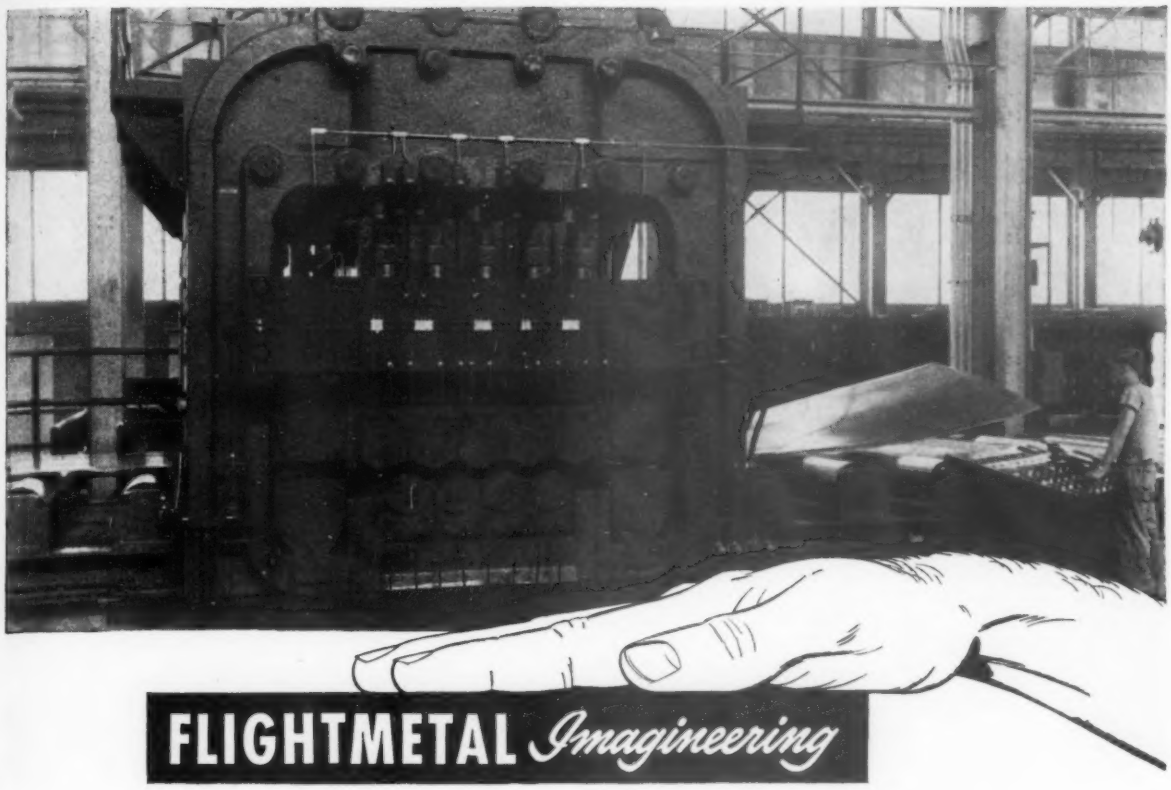

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for America's Air Might

All of these first-line fighters combine flashing speed with top dependability—characteristics that mark them as outstanding military aircraft. Significantly, each is powered by two Westinghouse turbojet engines.

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J-54010

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AVIATION
GAS TURBINES

of the R-2800-CB16 engines on DC-6s. Fuel distribution was suggested as a possible cause.

KLM, happy with its BG rear plug installation, indicated that unscheduled removal rates had dropped from 10-20 to 1-2 a month.

P&W said that it is considering using a colder plug in the rear position of the engine.

New Developments

Engineers generally agreed that not enough experience had been gathered on the effect of spark advance on plug performance. They suspect that there will be little difference in spark plug operation but look to improved fuel economy as a real advantage of the system.

• **Center Electrode Recession.** Champion admitted that center electrode recession was an annoying problem. The new R37-1E plug, currently starting into production, will have a glass seal which should ease this problem. Also, since it materially strengthens interior construction of the plug, the glass seal should help eliminate another complaint—internal ceramic breakage.

• **Cracked Ceramic Barrels.** Champion's R. K. Christie said 20% of all plugs scrapped were because of ceramic cracking. Engineers pointed out that often it is very difficult to distinguish between a crack, which will result in plug malfunction, and a scratch, which is harmless. One method suggested for differentiating between cracks and scratches was touching the mark with a fountain pen: if the ink runs along the line, it is a crack.

• **Melting Copper Center Core.** Champion stated that the mere presence of melted copper in the center electrode does not indicate the plug is defective. Ratings on plugs with copper melted from the center electrode are comparable with new plugs. Therefore it is reasonable to assume that loss of copper is a result, rather than a cause, of a malfunction. Pre-ignition, for instance, sets up very severe operating conditions on a plug. Conclusion is that copper melting usually results from transient engine conditions of high heat.

• **New Plug.** Eastern Air Lines and the USAF are testing AC's massive electrode plug, the AC171. It is too early to give results.

• **More Horses at Takeoff?** The Navy's BuAer asked the airlines if more horsepower is gained on takeoff when fine wire plugs are used. Trans-Canada Air Lines, having operated both types of plugs, said that it had detected no operational difference at takeoff powers. P&WA, who ran dynamometer tests to check this point, concurred that the plugs' takeoff power performance were

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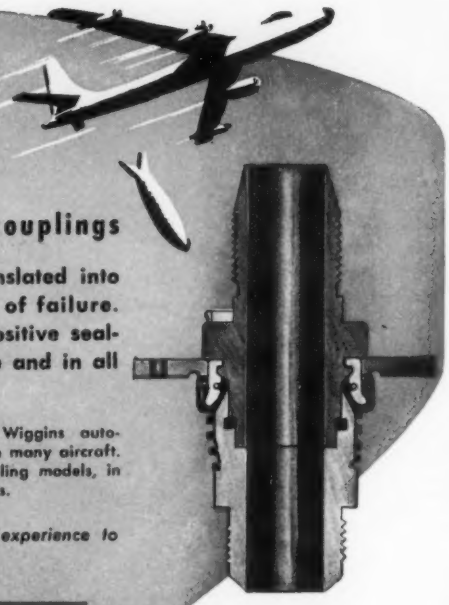

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practically identical. Yacovone added that he considered the hydraulic method of BMEP power transmission more accurate than the Magnasyn system.

Cold Starting

Engineers agreed that effective cold weather engine starting techniques are of prime importance.

As to the relative merits of the fine wire versus the massive electrode plug for cold starting, Northwest Airlines reported no appreciable difference on the Boeing 377. It had some trouble with Champion plugs in the R-2800, but remedied this by enlarging gaps and improving starting techniques.

TCA uses the massive electrode plug in the rigorous weather it operates through. It has no trouble because it maintains the aircraft in a condition where the massive electrode plug will operate as well as the fine wire by either hangaring the plane, heating the engine or running it up.

USAF commented that an advantage of the fine wire plug was that it did not ice-bridge, as often happens to massive electrodes.

SAS volunteered that that it had no trouble starting Champion-plugged engines.

► **Fine vs. Massive.** In reply to a USAF question requesting comparative data on fine wire vs. massive electrode spark plugs on low tension systems, Panagra stated that, on a test with two LT ignition systems, fine wire plugs were pulled at 850 hr. because of shell electrode breakage. The Champions went the full engine run. Erosion rate on both types of plugs was about the same.

TWA said its principal reason for changing to Champion plugs was economic, the massive electrode plug being much cheaper than the fine (platinum) wire plug. It added that the unscheduled removal rate improved somewhat with the changeover.

• **Fire Lean Mixtures.** P&WA asserted that fine wire plugs were capable of firing 5-6% leaner mixtures than massive electrode plugs—mixtures whose fuel/air ratio was 0.058.

Wright Aeronautical has found that certain engines require larger gaps (with either type of plug) than others. Examples: the R-3350 compound engine needs plugs with gaps set in the .015-.018 in. range and the R-1300 goes up to .020 in.

P&WA claimed that there was no difference in the detonation characteristics of the two types of plugs.

Evaluation

The USAF offered these comments concerning the AC281 spark plug: mechanical strength is good, erosion char-

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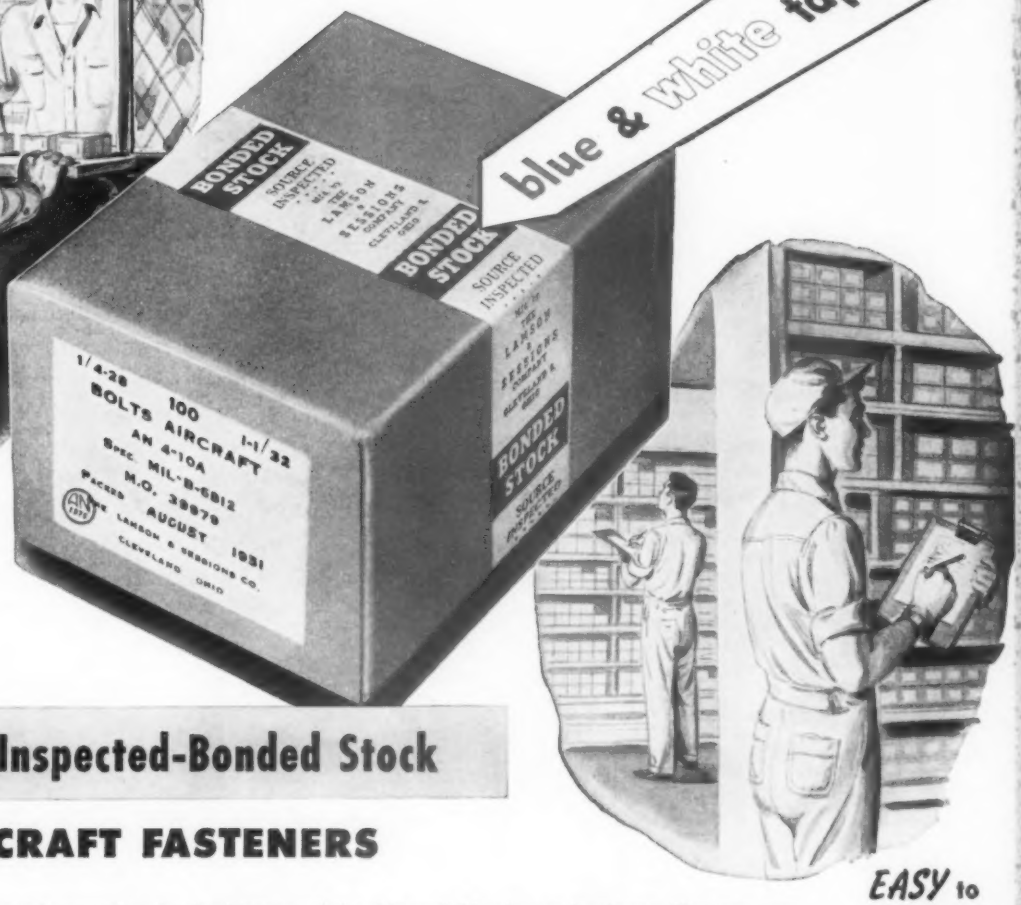

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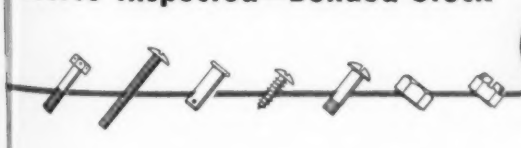

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acteristics undesirable. In the R-4360-53 engine it is experieneing some nose core cracking; suspects thermal shock caused by fuel injection.

• **Cracked Cores.** KLM complained that Champion plugs will keep on firing at low and medium powers—powers at which magneto checks are made when the core nose ceramic is cracked. Damaging pre-ignition can result because loose pieces of ceramic cannot dissipate heat adequately and become superheated. Since the plugs keep on firing, they cannot be picked up on a mag check.

• **Plug Burn-out.** Here are the recommendations on spark plug burn out procedures by the two reciprocating engine manufacturers:

P&W: Burn-out results can be beneficial. Bring engine manifold pressure up to field barometric pressure for optimum burn-out results. Nothing is gained by using higher manifold pressures. P&W cannot attribute valve or piston failures to this procedure.

WAC: Is also pro burn-out and likewise warns against using too high power with the procedure. Suggests running engine at 1,000 rpm., leaning out to best power and allowing engine to run a few minutes under those conditions.

Continental Air Lines found a definite correlation between engine troubles and spark plug troubles. "You don't have plug problems with a good engine."

TWA on the other hand, found a straight line relationship between engine time and spark plug removal rates. For the first 200 hr. of engine operation it has no plug removal to speak of. Plug removal rate increases steadily with engine life. TWA surmised that internal conditions of the engine caused this progressive increase in plug removal rate.

British European Airways reportedly uses a Swiss instrument to record manifold pressure, rpm. and altitude of its aircraft. Among other benefits, the records show whether crews follow prescribed procedures.

(This is the first of two reports on the Aircraft Ignition and Spark Plug Conference. The conclusion will appear next week.)

CAA Certificates French Overhaul Base

An air agency certificate has been awarded Air France's Courbevoie overhaul base, near Paris, by the Civil Aeronautics Administration.

As a result, the plant may operate as an approved aircraft engine repair station and overhaul American engines with full CAA approval for the finished product.

Air France says it already has given assistance to Trans World Airlines.

AEROTEC AUTOMATIC CONTROLS

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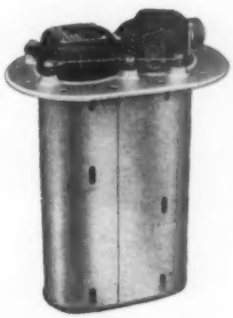

An Aerotec Dual Float Switch Top Mounted

Republic, Boeing, and other leading aircraft manufacturers are using many types of Aerotec Automatic Controls in increasing numbers. These controls are custom designed and built to meet specific problems of high speed and high altitude flight in today's aircraft. Each Aerotec automatic device passes rigid tests duplicating actual flight conditions to assure it's efficiency and dependability.

The planes shown above are typical designs that incorporate Aerotec Automatic Controls. The Republic F-84E Thunderjet, a combat-proven craft, uses Aerotec pressure switches and a new dual float switch suitable for tip or pylon mounted auxiliary fuel tanks. Boeing has long used Aerotec valves, float switches, and pressure switches on their famous planes.

When you are faced with problems of automatic controls for flaps, landing gear and cabin heater applications, fuel transfer, flow indication, etc., contact Aerotec. One of our instrumentation specialists is near you, ready to give prompt and able assistance at any time. Call or write.

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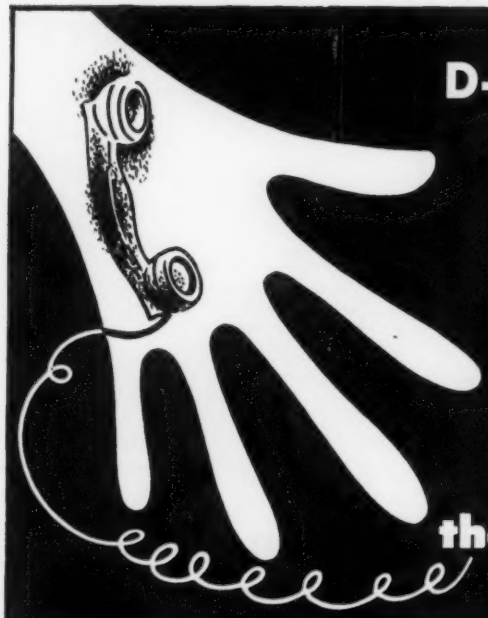

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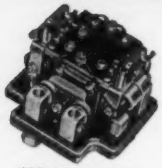
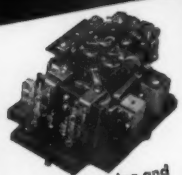

300-Amp Reverse Current Cutout

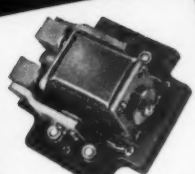
Overvoltage Relay


Fault Sensing and Generator Control

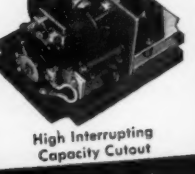
Jet Starter Relay

High Interrupting Capacity Cutout

Control Relay

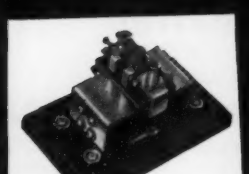

400-Amp Contactor

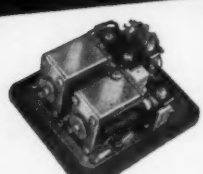
High Interrupting Capacity Contactor

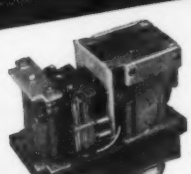

600-Amp Reverse Current Cutout

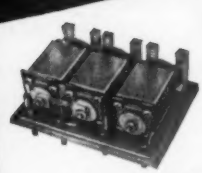
Equalizer Relay

50-Amp 120-Volt D-C Contactor


Undercurrent Relay

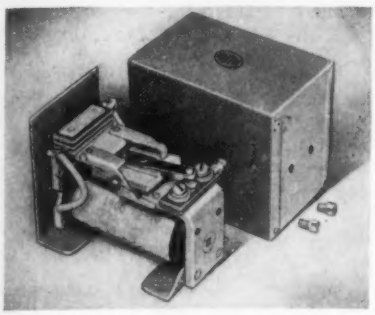

Cable Selector Relay


Generator Field Relay


Propeller Pitch Control

Hartman also manufactures Polarized Relays, Bus Tie Relays, Selector Relays, Starter Contactors, Exciter Control Relays, Differential Relays, Fault Relays, Time Delay Relays

NEW AVIATION PRODUCTS



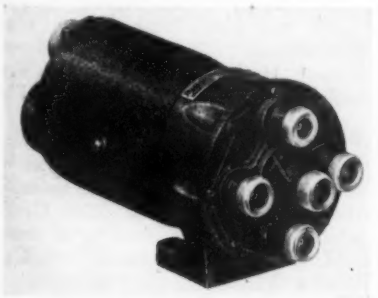
20G Avionic Relay

Recent addition to the avionic sales counter is a balanced armature developed for aircraft by the Auth Electric Co.

Custom-built to specific requirements, the relay is designed to withstand shocks and vibration up to 20G while holding contacts open or closed as required. According to the firm, the armature is balanced on the pivoted fulcrum on which it rotates in a manner that shock or vibration in any direction cannot rotate it.

As an example of operation, the relay, used in a 22 1/2v., d.c. potentiometer circuit under severe vibration described above, will pull in and close contacts with a maximum current drain of .0055 amp. and hold them closed with a draw of only .0005 amp. Contacts are rated for a current of .5 amp. at 110v., a.c., 60c. Relay is a single pole, single throw (with double break) type and weighs 7¾ oz.

Auth Electric Co., Inc., 34-20 45th St., Long Island City 1, N. Y.



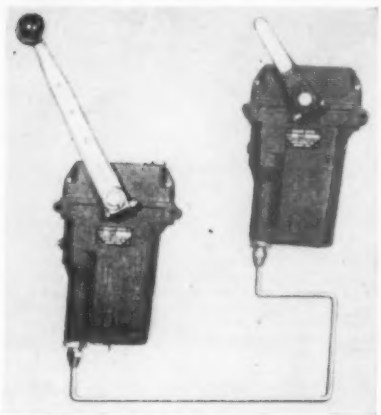
Airborne Radar Unit

Motor-driven coaxial switches for use with radar equipment in aircraft are being marketed by Transco Products, Inc.

Among various models available for military applications is the compact, single-pole, four-position switch shown. This unit, No. 1460-4, is ruggedly built to withstand extreme temperatures and shock encountered in military planes and meets applicable Air Force and Navy specifications, the company says.

Performance features listed by the firm include a frequency range up to 11,000 mc./sec., insertion loss under .5 decibels throughout operating range, and power handling capabilities equal to improved type N connectors. The switch can be driven by a motor operating on 24-28v. d.c.

Transco Products, Inc., 12210 Nebraska Ave., Los Angeles 5.



Plane Engine Control

A self-contained hydraulic remote control, reportedly used in British aircraft, but so far not in U. S. planes, is being marketed in this country by Sperry Products, Inc.

Sperry manufactures the control under license from the English firm, Exactor, Ltd. It consists essentially of a hand-actuated transmitter (lever-operated piston-spring assembly) and a receiver connected by a single tube. Hydraulic oil is sealed in the system and any movement of the transmitter handle is precisely duplicated by the receiver lever. Opposing springs of equal force in the master and slave units "balance" the control and virtually eliminate lost motion and backlash, Sperry says.

The lightweight system has possible application in aircraft throttle control, propeller operation, etc. Sperry claims it is the only single tube, balanced, self-contained hydraulic remote control now made. Among virtues of the control listed by the firm are minimum backlash, low friction and ease of installation. Sharp bends can be made in the tubing, without affecting operation, says the firm.

A complete system, weighing about 7 lb., has a maximum rated capacity of

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Sperry Products, Inc., Danbury, Conn.

Climate Study Aid

A portable electronic climate-survey system, designed for field microclimatic studies at airports, in rocket and guided missile research and for other climatic investigations, has been placed on the market by Beckman & Whitley, Inc.

The system is self-contained (operated by batteries) and combines "drag-free" anemometer characteristics and electronic data-gathering techniques to provide accurate recordings or wind direction and wind speeds. Anemometer speed ranges are 0 to 10 and 0 to 30 mph. The entire installation weighs 100 lb. with batteries.

Beckman & Whitley, Inc., 906 San Carlos Ave., San Carlos, Calif.

ALSO ON THE MARKET

Coiled springs used in instruments and other components strongly resist effects of moisture, weathering and chemical action when protected by a tough, thin coating which remains flexible down to —70F. and won't break down at temperatures up to 250 F., says developer, Robert Hetherington, Congress Fan and Electric Co., Daytona Beach, Fla.

Faster, simpler measurement of cam contours, both in angle and amount of eccentricity, is made possible by using the new Optical Cam Rise Gauge which also reduces chances of error, says maker, F. T. Griswold Mfg. Co., Wayne, Pa.

Vertical milling head with micrometer precision for angle boring and milling on horizontal milling machines is announced by a California firm. A vertical spindle with travel of 1¾ to 3 in. has a micrometer feed calibrated in .001 in. increments. Gear rating is 1¼ to 15 hp., running in oil. Twenty-five models are available from Brown Mill Tool Co., 5443 San Fernando Road West. Los Angeles.

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Cherry Rivet Company Lock Bolts are high strength, structural fasteners specifically designed to lower overall costs. One man installs them with a special pneumatic tool. Installation time is less than ½ that of conventional bolts and nuts and similar high strength fasteners.

Installed Lock Bolts are 50% lighter in weight than equivalent AN bolts. Their tensile strength is equal to that of the same sized AN bolt, yet their shear strength is considerably greater. On installation, the Lock Bolt clamps the material being fastened tightly together, and securely clinches it under tension. The clamping action is sufficient to pull together a gap between sheets of as much as ¼".

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Grip Lengths: 1/8" to 1-15/16"
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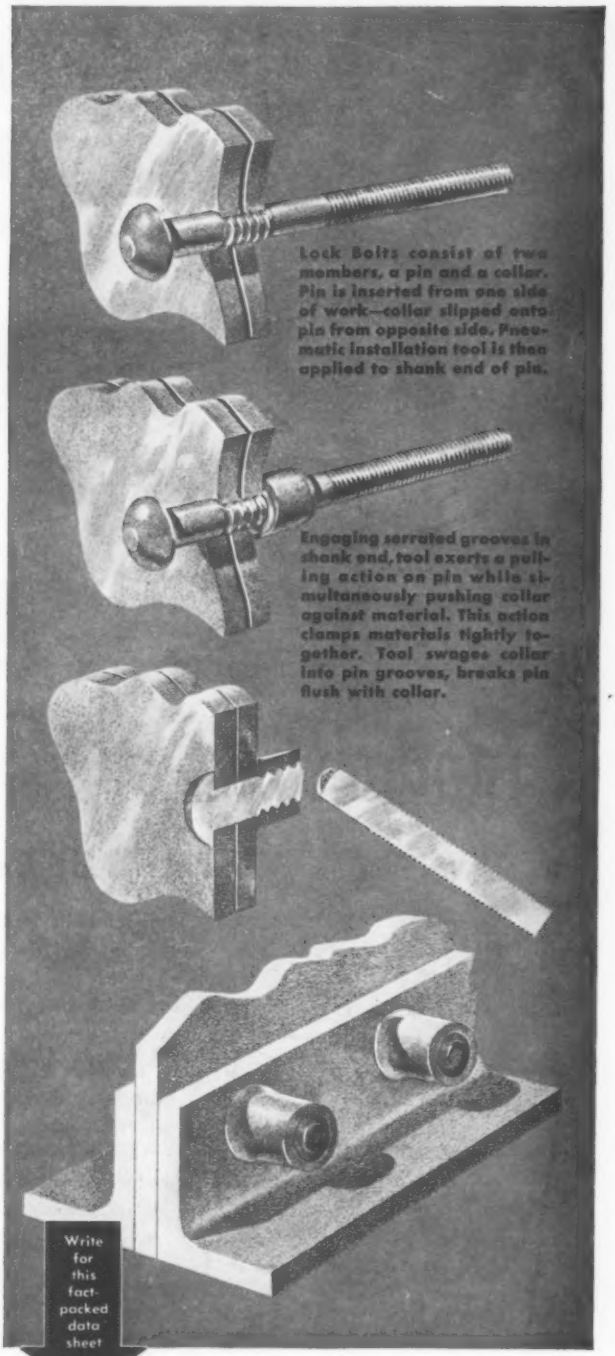
Lock Bolts consist of two members, a pin and a collar. Pin is inserted from one side of work—collar slipped onto pin from opposite side. Pneumatic installation tool is then applied to shank end of pin.
Engaging serrated grooves in shank end, tool exerts a pulling action on pin while simultaneously pushing collar against material. This action clamps materials tightly together. Tool swages collar into pin grooves, breaks pin flush with collar.
Write for this fact-packed data sheet

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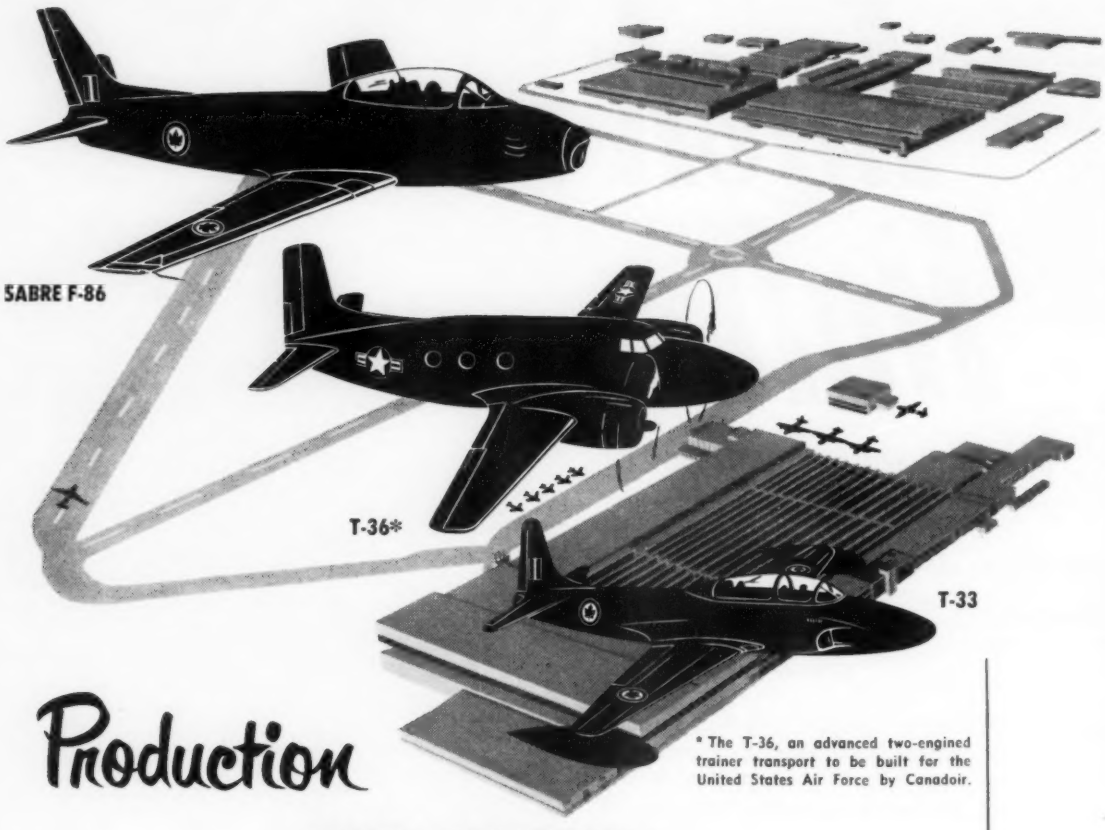

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CASI-BUST

Causes Traced for UAL DC-6 Crashes

• One plane was off beam, other off compass heading.

• Pilot unfamiliarity with plane also played a part.

By F. Lee Moore

All the facts about the two fatal United Air Lines DC-6 crashes this past summer probably will never be known. But a team of investigators from United, Air Line Pilots Assn., and the Civil Aeronautics Board already have found enough for experienced observers to draw their own conclusions about the probable causes.

While new facts may be uncovered later to change these tentative beliefs, this is the way many investigators now think the accidents occurred:

• **Crystal Mountain crash,** Colorado, June 30: probable cause is stated by Air Line Pilots Assn. investigators as misidentification of a range station. Pilot apparently thought he was on low-frequency Denver range. But his radio was tuned to the audio signals of the very-high-frequency Denver range.

Basic accident causes: 1. Pilot pushed the wrong one of six identical switches ranged in a row by United's cockpit engineers; 2. The CAA code identification of both Denver ranges was identical: D-V-R; 3. Captain was a DC-3 pilot, and it was suggested he might have been thinking at 180 mph, instead of 300 mph.; United had assigned him to DC-6s and DC-3s and even sent him to DC-4 school alternately in the last three months, since his DC-6 checkout.

• **Oakland crash,** California, Aug. 24: probable cause tentatively believed by investigators is that the pilot was trying to fly by glimpses of the ground instead of on instruments during instrument approach. He was off course and too low when he hit. Neither of his two low-frequency radios was tuned to the Oakland range, on which he was supposed to be approaching.

Basic accident causes surmised: 1. Short-cutting instrument procedure due to haste; and 2. Overconfidence in a control area he had flown for 12 years.

Oakland Crash

Dawn was breaking across cloud-covered hills around Oakland Airport. United Air Lines DC-6B flight Number 615, bound in from Chicago, called approach control. The pilot asked permission to fly direct to the Newark marker for straight-in range approach. Approach control cleared him to Newark marker to fly 500 feet above the cloud top.

At 0422 the pilot reported:

"Approaching the Hayward compass locator, how about a straight-in ILS approach?" (A shortcut straight-in ILS approach is not allowed from flight path he had, coming straight across from Altamount to Newark marker.)

After this call, another voice called approach control. Approach control told the United pilot to stand by. (The approach controller thought C-46 flight 97M was trying to report passing the Newark marker. This C-46 was the only other plane in the control area at the time.)

At 0423 approach control told the United pilot there was a plane ahead of him. The United pilot asked approach control to disregard his previous request for straight-in ILS approach, he would be over Newark soon and would take the range.

▶ **Missed Marker**—Next the C-46 pilot told approach control he had missed the Newark fan marker and was proceeding at least 500 feet above the cloud top to the Oakland range station.

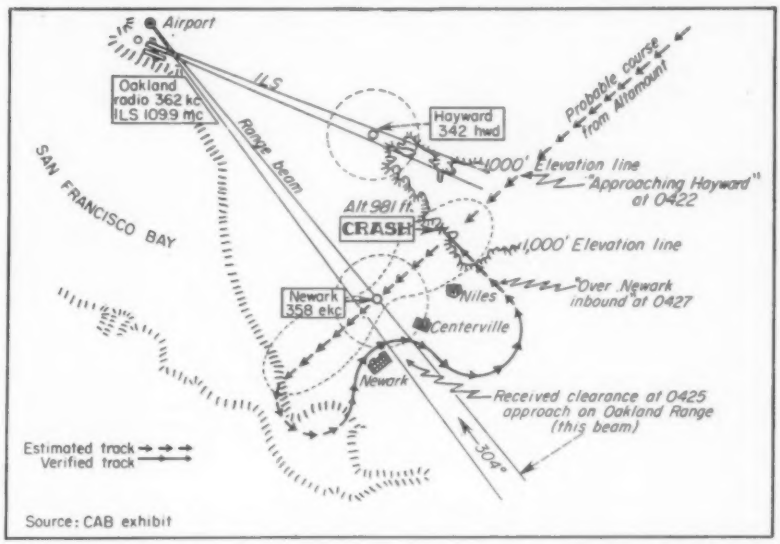
At 0425 the United pilot was cleared for straight-in approach on the range, beam heading 304 deg. Two minutes later—at 0427—the United pilot reported:

"Over Newark inbound." (But he actually was about three miles northeast of Newark, heading parallel to, but not near, the beam.)

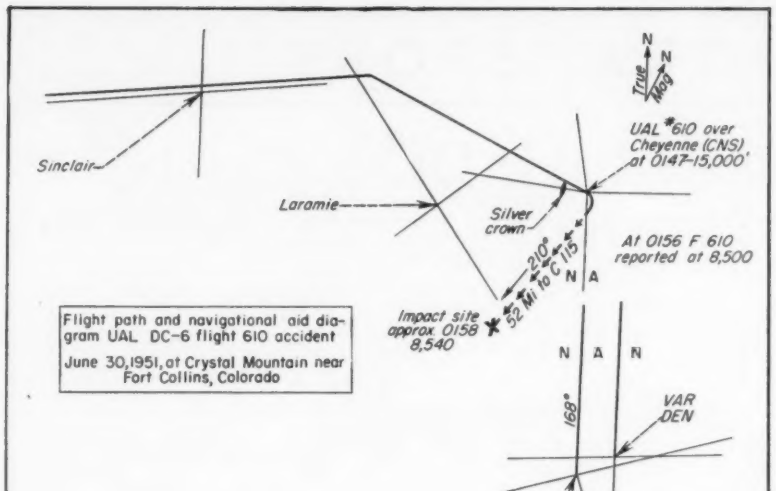
About one minute later, United Flight 615 crashed into a 1,007-foot hill at 981 feet altitude. All 50 persons aboard were killed. One witness saw the plane fly into the hillcrest and crash. Two other ground witnesses had seen the plane maneuvering—first in a right hand turn, then in a left—a few minutes before the crash. They could see him without the aid of lights. They said the plane disappeared from their view occasionally behind scattered low clouds.

▶ **Findings**—Inspection of the wreckage showed that when the plane hit, neither of the two low-frequency radios was tuned to the Oakland range. Yet the pilot was cleared to come in on the Oakland range. One radio was tuned to the Hayward marker, the other to the Newark marker.

Volume control of both the automatic direction finders (ADF) was found turned on about one-third—which is lower than normal if used on audio; so it is a question whether pilots could have heard identification code of either station; but the visual needle indication of the ADFs would neverthe-



CAB MAP shows pilot was considerably off-beam when UAL's Oakland-bound DC-6B crashed into a 1,000-ft. hill while approaching airport Aug. 24, killing 50 aboard.



ALPA MAP shows UAL's DC-6 which crashed into Crystal Mountain, near Ft. Collins, Colo., June 30, was flying 210 deg. heading instead of prescribed 168 deg. after passing over Cheyenne enroute to Denver.

less function. Pilot's ADF was tuned to Newark marker. Copilot's ADF was on Hayward marker and at time of crash it indicated plane headed direct toward Hayward.

Investigators have found no sign of instrument, radio, engine or airframe trouble prior to impact. Ground radio aids were found to be functioning normally.

The track of the plane in the control area has been estimated with reasonable accuracy. (See map p. 63: broken line is estimated track; solid line is ground witness-verified track, not exact but approximate.)

Weather at Oakland had been reported as 1,400-ft. overcast with 10 mi. visability. The C-46 later reported weather clear and unlimited above cloud tops near 2,000 ft.

▶ **Gear Down**—Main landing gear of the DC-6B was down. Nose wheel was partly or all down, it is believed.

Pilot had a total of 12,033 hr. flight time, of which 816 hr. were instrument flight time. He had 418 hr. in the DC-6 and 14 hr. in the DC-6B. Cockpit and flight characteristics of the DC-6B are nearly identical with those of the DC-6.

Pilot had an instrument check flight in the Oakland area on June 11. He had flown in the Oakland and San Francisco areas since 1939 and had taken many instrument check flights there. He was familiar with the Newark marker and approach.

The approach controller said at the hearings that he could not remember any pilot ever having made an instrument procedure turn where this one did —to the southeast of the Newark marker.

▶ **Cause Analysis**—The theory of some investigators is that the pilot, required to pass over Newark marker on his first pass at 3,500 ft., descended rapidly; he made visual contact somewhere near the town of Newark, located just off the approach leg. He saw the town of Niles ahead and thought it was Newark, the theory goes.

He therefore made a procedural swing around Niles and reported "over Newark, inbound." He hit on a heading of about 297 deg. magnetic, flying almost parallel to the inbound beam heading of 304.

It also is considered possible that the pilot thought the copilot's ADF was tuned to Oakland range, instead of still on Hayward marker. The copilot's ADF needle was indicating station about straight ahead when plane hit.

Crystal Mountain Crash

At 1:04 am on June 30, 1951, United Air Lines DC-6 Flight 610 from San Francisco reported over Rock Springs, Wyo., flying at 15,000 ft. over the Rockies. The mountains below were hidden by thick overcast from 15,000 ft. down to about 8,500.

Pilot estimated arrival over Denver at 2:07. Later he reported over Silver Crown fan marker 13 mi. west of Cheyenne and requested a lower altitude than 15,000.

Denver traffic control cleared him to descend to 8,500 ft. after passing Cheyenne. Pilot reported at 1:47 over Cheyenne at 15,000 ft. Denver gave him the latest altimeter setting and he started descent heading into Denver, estimated only 20 min. south.

Nine min. later the pilot reported leveling out at 8,500 ft.

Less than four min. after leveling out at 8,500 ft. the plane struck Crystal Mountain. Plane was believed to have been on heading 205 deg., although course to Denver was 168 deg. It hit at altitude 8,540 ft. All 50 persons aboard were killed.

▶ **Findings**—Time from Cheyenne to impact site was about 11 min. Pilots apparently knew they were flying a course of 205-210 degrees. (The two flux gate compasses were found indicating 210, the magnetic compass and directional gyro at 210 and the copilot's dual indicator azimuth scale was jammed at about 202.)

On the captain's audio radio panel the following showed: Denver visual-aural range (VAR) was found set up on the VHF receiver. Range switch was turned loud enough in this receiver to be heard by the captain. The low frequency ADF was tuned to Denver low frequency station but the range selector was off and the voice selector was on.

If the pilot was listening to this combination of receivers he would hear the static from the low frequency and course signals from the high frequency range.

Not enough remained of the copilot's audio selector panel to make a complete analysis of his radio setup.

Flight check showed the navigational aids in the area were operating normally.

All evidence indicates the airplane was airworthy in every respect at time of crash.

In the 11 min. since leaving Cheyenne range station, the pilot had travelled 52 miles on a heading about 45 deg. off to right of his proper course.

ALPA investigators reasoned from this fact and other evidence that cause of the crash could only have been "that some navigational problem was not correctly solved."

▶ **Navigation Facilities**—Then pilot investigators undertook a study of the local navigation aids to see if they could have misled the pilot. They found a potentially dangerous combination in the near-identical setup of the two Denver ranges (see map):

• **Both ranges** have parallel north legs. Heading south on the north leg of the low frequency range the pilot has the "N" on his right and "A" on his left. On the high-frequency range he has the "A" on his right and "N" on his left.

▶ **Probable Cause of Crash**—So, the Air Line Pilot investigators reasoned "it would therefore be possible for a pilot listening to the high frequency range

and believing he was listening to the low frequency range to make a 45 deg. cut at the 168 deg. north leg, making his heading approximately 210 in an attempt to get on to the low frequency north leg of DEN (Denver range). It was pointed out, however, that if a pilot were listening to the high frequency range he would get an "A" signal in a northwest quadrant and would never get over to an "N."

If the voice switch in the low frequency range were turned on the pilot would hear the static connected with the low frequency range and believe that he was listening to a low frequency range. Since, in this case, the pilot had a 30-mph. tailwind up to Cheyenne, he reasonably could believe that he would have a similar crosswind on the way into Denver, pilots said.

He could believe that a crosswind would keep him away from the range leg a little longer than normally (i.e., the 11 min. to the impact)."

ALPA report adds: "The captain had only 63 hr. and 32 min. on the line in DC-6 equipment although he checked out in April, 1951.

"Although the captain had sufficient time to complete 100 hr. in DC-6s, he did not. In the interim period he had gone through DC-4 school and was flying a DC-3 schedule while acquiring his 100 hr. four-engine familiarization flight time in both DC-4s and DC-6s."

Centerline Runway Lighting Is Approved

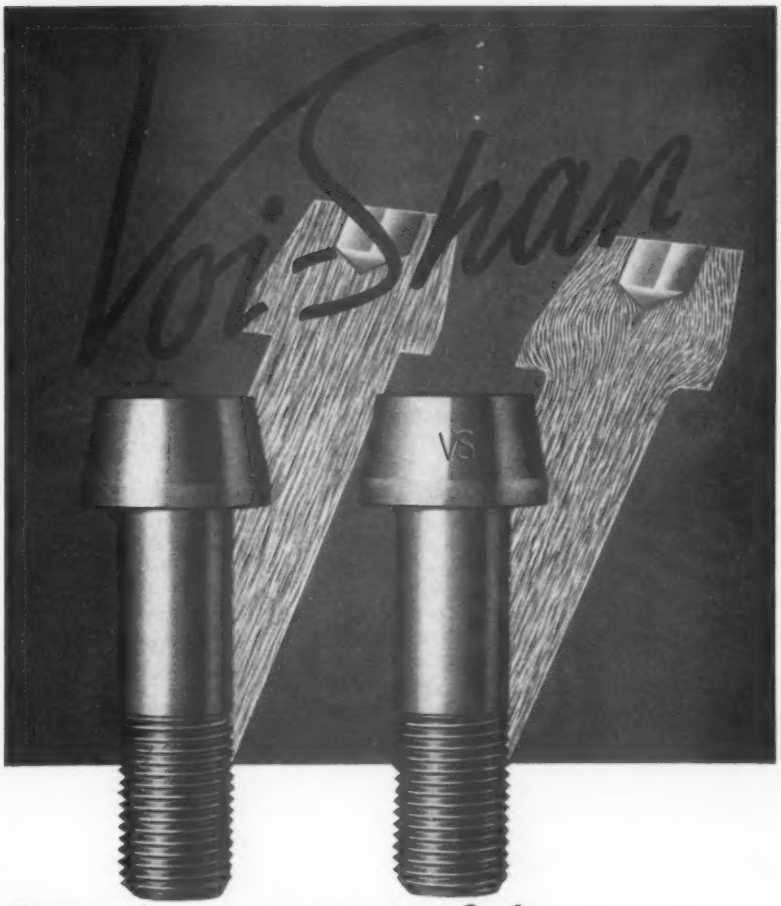
A majority of the world's experts on runway approach lighting have at last agreed upon the centerline system of lighting.

They came to unofficial majority agreement after two weeks comparative study and discussion in Washington and New York (AVIATION WEEK Oct. 8, p. 16). Representatives of various governments in International Civil Aviation Organization officially were only observing comparative demonstrations and study data presented.

But airlines' delegates to International Air Transport Assn. decided in New York last week on a firm recommendation of the centerline system to ICAO. ICAO will meet next year to consider adopting it as standard approach lighting for the world's airports.

▶ **British Standard**—Britain's foremost expert on approach lighting development, A. C. Calvert, already has shelved most of his study of approach lighting and is now working on a new and growing problem.

To make a safe final flare-out and landing in bad weather, a pilot must see a minimum of 12 runway lights on each side ahead of him, and preferably more, says Calvert. And that is cutting



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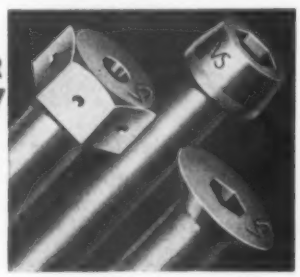

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the risk pretty fine, others say. Right now, that's mainly a military problem, as the military must be prepared to fly in commercially unsafe weather. But it's a problem already bothering commercial operation, too.

Since the lights are 100 ft. apart, 12 lights ahead approximate a quarter-mile. That appears to be the extreme minimum safe visibility for the future.

"Frankly," says Calvert, "although we've searched we've found no way of bettering that."

► **Pilots Blinded**—If the lights are made more intense than they now are, the pilot may be blinded. Then there's the problem of giving the pilot more indication of the runway's texture, or depth, so he can sense where it is.

At least two recent airline accidents in Europe are attributable to the inadequate lighting of runway threshold for bad-weather approach and landing, says Calvert. In both, he says, the pilots came suddenly out of the murk and straight onto the few threshold and runway lights visible; tendency of the pilots, given inadequate runway perception, was to dive into the small island of glowy light they could see. They flew straight into the threshold with no flare-out.

How to beat that situation is the number one problem of airport lighting coming up now, says Calvert.

Power-Loss Signal Decision Up to Pilots

Proposal to replace automatic propeller feathering devices by a pilot-warning signal for power loss indication is being favored by CAB technical staff as well as airline and pilot observers.

The CAB has issued a Civil Air Regulation draft release asking for comment on why airlines should not be permitted to do this. If formal pilot comments are favorable, as they are expected to be, the CAB revision should go through quickly.

All that needs to be done, then, is to connect the torque meter indication of power loss to warning light and disconnect it from the present automatic feathering device. Setup for this, minus the warning light, is already available on all modern transports except the Constellation.

This allows the pilot to decide whether or not power loss is sufficient to warrant shutting down the engine or not. Feeling is that since the warning comes as soon as power loss starts, pilot has time to decide and act. Sometimes power loss is not complete and does not warrant stopping the engine altogether the way automatic prop feathering does.

No change in allowable gross weight would be involved in the proposed regulation re-write.

First Ten 4-0-4s Due Next Month

First ten of 101 Martin 4-0-4 airliners ordered by Eastern and Trans World probably will be delivered by the end of November.

The new plane may not get a single trade name, such as Skymaster, Stratocruiser, Convair-Liner, Constellation or Comet, because the two airlines ordering big fleets could not agree on a name, though over a hundred were suggested.

Eastern will call its 60-plane 4-0-4 fleet "Silver Falcons" and promises an intensive advertising campaign for the new Martin. TWA hasn't announced what it will call its 41 4-0-4s yet (40 for company, one for Howard Hughes). But they probably won't be called Silver Falcons.

Delivery schedules aren't firm yet, but industry observers guess less than a dozen will be delivered by Nov. 30, the rest to follow quickly. Part of the indefinite schedule is due to last minute alterations and improvements being made at the Martin plant instead of airline bases.

Nonskeds Fly Billion Safe Passenger Miles

This week the nonsked airlines enter their seventeenth month of transportation without a single passenger fatality—about one billion safe passenger miles. This is an enviable record for air, rail, auto or sea transport, say Commerce Department officials.

If only public transportation is included, the nonsked airlines have flown over two years without a fatality.

According to the Civil Aeronautics Board, the only nonsked passenger fatality since July of 1949 (two killed) was a private charter flight bringing labor from Puerto Rico on June 5 of last year (28 killed). Last year's 766,507,000 nonsked passenger miles flown included 28 fatalities, all in the one Puerto Rican flight. That made the fatality rate 3.8 per 100 million passenger miles for the year 1950.

This year the fatality rate is zero. Nonskeds already have flown over three-quarters of a billion passenger miles this year without a fatal accident.

New Base Planned To Test Aussie Jets

(*McGraw-Hill World News*)

Melbourne—An experimental base to test Canberra bombers and other jet aircraft to be manufactured in Australia is planned near Lara, Victoria.

Assembly facilities will be provided at the new $7-million field and plans provide for eventual transfer of the Australian government's aircraft manufacturing from Fishermen's Bend, Melbourne, to the new facility.

At present, the Fishermen's Bend plant will continue to operate and in about two years will be in production of the first Australian-built Canberra.

SHORTLINES

▶ **Acme Air Cargo** has started domestic air freight service daily New York-Miami. Acme has heretofore been international only, mostly trans-Atlantic and Latin American.

▶ **Air Coach Transport Assn.** new board of directors has suspended ACTA membership of New England Air Express pending a hearing of the nonsked's explanations on charges of "refusal to haul passengers as contracted for."

▶ **Air Line Pilots Assn.** president Clarence Sayen says that "ALPA intends to increase the entire tempo of its activity." This includes contract negotiations. Eight contracts have been signed since the recent reorganization of the association. Activity in operations safety and engineering in which pilots are becoming even more interested than before, is increasing.

▶ **All-American Airways** common stock will be listed on the New York Curb Exchange Nov. 5. Company has about 2,000 holders of the 535,979 shares outstanding. President Robert Love owns 50-60,000 shares or about 10% . . . has asked CAB for route extension to seven cities in Ohio and W. Va. System now serves 48 cities in the Middle Atlantic area. Extension would give Northern Pa. its first commuter airline route, AAA says.

▶ **American Airlines** September traffic "was disappointing," the airline says, but passenger miles were up 42% to 243,048,000; freight down 12% to 3,-

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136,000 ton miles; express down 5% to 648,468 ton miles; mail up 44% to 1,189,116 ton miles, compared with a year ago. Most "disappointing" was a 2% drop in passenger traffic from August.

▶ **Bonanza Air Lines** reports an all-time high load factor of 42½% for September. Quarterly load factor averages this year: Jan.-Mar. 37½%; April-June 38½%; July-Sept. 40%.

▶ **British Overseas Airways** is concentrating management at London Airport—announces the following new management promotions: Charles Abell as deputy operational director (engineering), and J. C. Harrington as deputy operations director (operations), both reporting to Sir Victor Tait, operations director. A. C. Campbell-Orde moves from deputy operations director to operations development director to report to the board through deputy chairman Whitney Straight on all matters of future aircraft, equipment and operating technique. H. Houchen, former regional operations director, becomes general manager of stations and traffic—"to insure speed and efficiency of ground services." Sales planning manager R. M. Hilary's title has changed to assistant sales director (planning), under sales director Keith Granville.

▶ **Capital Airlines** reports August operating profit up 50% to $476,614 and net profit up 32% to $298,528, compared with year ago. Eight-month net profit is $1,225,171 or $1.57 a share, compared with $766,921 or $1.50 a share a year ago; mail pay these eight months has amounted to 4% of total revenue, whereas a year ago it was 14½%

▶ **Civil Aeronautics Board** is expected to retract its earlier-proposed firm requirements that any new transport certificated must give stall warning "at least 7% above stall speed." (AVIATION WEEK, Oct. 15, p. 64-65.) But some officials of both CAA and CAB are going to urge airlines and manufacturers to consider using a prestall warning device with "stick shaker" on transports that give barely adequate prestall warning. CAB says it will add a clause to all future local service airline certificates that they "will be primarily engaged in short-haul air transportation as distinguished from the service rendered by trunkline air carriers." This makes official the purpose expressed by the locals this year "to continue to fulfill solely the responsibilities of local service carriers and remain local service carriers" . . . CAB examiner Herbert K. Bryan recommends that partners of Lehman Broth-

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By *Leslie E. Neville*
Curtiss Wright Corp., Former Editor, Aviation

532 pages, 8½ x 11, 788 illus., $10.00

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Includes design details for land planes and seaplanes of both metal and composite construction, grouped for easy reference in terms of power plants. Such military planes as the Messerschmitt ME163, the P-39, and the Republic Seabee are shown, and several German and Japanese designs are compared for efficiency and practicability.

". . . enables aircraft designers and engineers to acquire quickly an appreciation and understanding of design as exemplified in aircraft and their power plants."
—AIR FORCE TIMES

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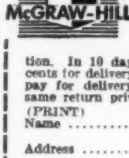
4. Fuselage, Body, and Hull Design
5. Landing Gear Design
6. Control System Design
7. Fuel and Lubrication Systems
8. Power Plant Installation
9. Miscellaneous Design Details
10. Rotating Wing Aircraft
11. Turbine Engines



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ers divest selves of interlocking relationships between National and Pan American, Pan American and American Export Lines, Pan American and United Fruit Co., and Convair and Continental Air Lines.

▶**Delta Air Lines** directors have re-elected all officers, declared a fourth 25-cent dividend for holders of Dec. 5 and okayed a cost-of-living salary raise for employes.

▶**Flying Tiger Line** has granted 8-cent-an-hour wage increase to mechanics, cargo handlers and freight dispatchers of the IAM. And vacation allowance now goes with one year's work instead of two . . . Stockholders have approved issuance of 500,000 shares of 5% preferred stock $10 par and additional 500,000 shares $1 par common. Company plans to issue 99,000 of the preferred "as a dividend on 600,000 'free' shares of the common stock," but to issue no new common.

▶**KLM Royal Dutch Airlines** has started the first Germany-South Africa service direct. Flight is via Frankfurt from Amsterdam to Johannesburg on DC-6.

▶**LAV, Venezuelan airline,** has CAB order to show cause why the Board shouldn't cut its U.S. operations to equal limited rights Venezuela has so far granted U.S. carriers. LAV now has nonstop New York-Maiguetia, Venezuela rights as well as Havana and Montreal to New York runs. But Venezuela won't let Pan American fly New York-Caracas nonstop.

▶**Pan American World Airways** London station has an on-time record of 189 consecutive Stratocruiser flights dispatched without a mechanical delay or turnback over a 3½-month period.

▶**Northwest Airlines** agreement to operate the Japanese airline NKKK includes maintenance as well as flying of the three planes that were expected to arrive Tokyo this week (two 2-0-2s, one DC-4). "Later," says NWA, "Northwest will train native pilots and maintenance mechanics for operations duties." NWA-operated schedules now include two round-trips a day Tokyo-Osaka and three a week Sapporo-Fukuoka. Next expansion planned is one-a-day Fukuoka-Osaka-Nagoya-Tokyo.

▶**Seaboard and Western Airlines** has been participating in a Memphis-to-Newfoundland airlift of prefabricated houses for Air Force personnel to winter in Torbay's Northeast Air Command Hq.

SEARCHLIGHT SECTION

(Classified Advertising)

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P-2214, Aviation Week
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For:

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CIVIL ENGINEERS
ELECTRICAL ENGINEERS
ELECTRONICS ENGINEERS
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GOODYEAR AIRCRAFT CORPORATION

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- STANDARDS AND PROCESSING ENGINEER
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P-2250, Aviation Week
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35	RA10-DB	Receiver
20	TA-12B	Transmitter
150	DA-1F	Dynamotor

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500	3506	Flange
130	8288	Follower Ass'y
814	35814	Blower Ass'y
182	46400E	Liner
30	48346	Cylinder
53	48362	Shaft
175	48363	Shaft
56	48392	Sump
390	48461	Gear
78	76236	Gear
1178	84289	Bearing
113	84487	Housing
77	84591C	Nose Housing
200	48350-D	Crankcase Ass'y
200	84083	Cylinder
100	84084	Cylinder
200	84085	Cylinder

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4000	KF4
3000	KF4H
30000	KP4R16-2
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28000	KS6A
34600	NR6L12
7000	38KD4
6600	RE3MR3
5000	F35-14

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Quantity	Part No.
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161	420 EC
160	420 DY
26	550 CD
14	550 CG
195	550 AJ
195	550 CP
104	550 EC

ACCUMULATORS

Quantity	Part No.	Mfg.
53	AN6203-3	Bendix-10"-1500 P.S.I.

LIGHT ASSEMBLIES

Quantity	Part No.	Mfg.
2000	AN3096-4	Grimes (Amber)
800	AN3096-5	Grimes (Red)
380	AN3096-6	Grimes (Green)

VALVES

Quantity	Part No.	Mfg.
478	D9530	Adel
233	D9530	Adel
498	D9560-2	Adel
744	D10044	Adel
2200	AN4078-1	United Aircraft (Oil Dilution)
50	572-3A	Eclipse
244	D10051	Adel

BLOWERS

Quantity	Part No.	Mfg.
25	U702-15	Joy
16	125J-6	Dynamic Air Eng.
43	4589-AA-6C	Dynamic Air Eng.
24	8861G-6C	Dynamic Air Eng.

OIL COOLER ASSEMBLIES

Quantity	Part No.	Mfg.	Description
45	AN4103-2	Clifford	Brass (Valve # U4785)
38	18597-2	Airesearch	Aluminum (Width 8") (Length 9")

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230	MF9-713-15A	Vickers	Hydraulic
90	AN6102-1(8818-2)	Adel	Fuel
160	2E492E	Pesco	Fuel
700	TFD 8600	Thompson	Fuel Booster
125	D7818	Adel	Anti-icer
170	2P771-A	Pesco	Fuel Booster
250	AN4014	Erie Meter	Wobble (D-3)
300	1H260-K & KA	Pesco	Hydraulic

INSTRUMENTS

19	AN5531-1	G. E.	Tach. Generator
1000	AN5780-2	G. E.	Wheel & Flap Position Indicator
400	AN5780-2	Weston	Same as above
1000	AW2-658	U. S. Gauge	Air Pressure Gauge
16	76B19	Lewis Eng.	Cyl. Head Temp.
10	4682	Lewis Eng.	Air Temp. Ind.
31	47B21	Lewis Eng.	Temperature Ind.
12	47B22	Lewis Eng.	Temperature Ind.
20	47B23	Lewis Eng.	Temperature Ind.
36	47B24	Lewis Eng.	Temperature Ind.
10	76Z2	Lewis Eng.	Air Temp. Ind.
11	76B4	Lewis Eng.	Temperature Ind.
20	77C4	Lewis Eng.	Temperature Ind.
21	77C5	Lewis Eng.	Temperature Ind.
85	727TY72Z2	Weston	Left Wing Anti-icing
88	727TY73Z2	Weston	Right Wing Anti-icing
83	727TY74Z2	Weston	Tail Anti-icing
11	2227-11D-3A	Eclipse	Dual Tachometer
22	8DJ-29-AAY	G. E.	Indicator (Cowl Flap)
45	254BK-6-052	Kollsman	Differential Pressure Ga.
25	906-6-011	Kollsman	Dual Altimeter and Differential Pressure Ga.
8	14601-1G-B1	Eclipse	Altitude Gyro
22	15100-1B	Eclipse	Pitch Trim Ind.
10	20000-8A-14	Eclipse	Magnesym PositionInd.
23	20100-11C-4-A1	Eclipse	Magnesym Wing Flap Ind.
40	23000-2A	Eclipse	Position Transmitter
25	46N2	Jaeger	24 Hour Clock

MISCELLANEOUS COMPONENTS

83	A4934	Delco	Motor
50	R8D2220	Holtzer Cabot	DC Motor
49	FD65-5	Diehl	Motor
47	FD65-6	Diehl	Motor
116	A371205	Dumore	Motor
780	A371206	Dumore	Motor
115	P4CA2A	Parker	Primer
80	AN3213-1	Scintilla	Ignition Switch
568	A-9 (94-32226)	Nasco	Ignition Switch
687	RS-2	Mallory	Selector Box
90	JH950-R	Jack & Heintz	Starter Motor
492	S-841 (94-32253)	Electronic Labs	Box
6	FA122	Wallace & Tiernan	Flasher
1000	T3018-A	Bendix	Interphone Box
140	K14949E	Marquette	Windshield Wiper Kit
73	3123-3A	Eclipse	Warning Unit
188	EYLC-2334	Barber-Colman	Control
11	12086-1C	Eclipse	Amplifier
174	450-0	Skinner	Gasoline Filter
250	558-1A	Eclipse	Oil Separator
100	564-2A	Eclipse	Oil Separator
100	716-3A	Eclipse	Generator (NEA-3A)
5	656536-421	Sperry	Controller Pedestal (A-12)
37	117-47	Edison	Detector
89	318	Edwards	Horn
280	921-B	Stewart-Warner	Heater (200000 BTU)
340	981280	Kidde	Co2 Cylinder
85	12924-2	Adel	Lock Valve
90	923748	Kidde	Oxygen Cylinder
80	DW28	Eclipse	Transformer
97	6041H-146A	Cutler Hammer	Relay (B-12)
22	0655-D	Aro	Oxygen Regulator
22	M-2031	Air Associates	Actuator
148	PG208AS1	Minn. Honeywell	Air Ram Switch
33	DW47	Eclipse	Transformer
11	DW33	Eclipse	Transformer
65	ASDC2	CO2 Mfg. Co.	Fire Detector
750	ND21	American Gas Accumulator Co.	Time Delay Relay
30	UA-3150	United Air Prod.	Oil Temp. Reg. 5"
29	UA-3160	United Air Prod.	Oil Temp. Reg. 6"
95	UA-3160C	United Air Prod.	Oil Temp. Reg. 6"
73	UA-6007-CF-DV5	United Air Prod.	Oil Temp. Reg. 7"
14	UA-6009-S-30	United Air Prod.	Oil Temp. Reg. 9"
11	UA-6012K-S30K	United Air Prod.	Oil Temp. Reg. 12"

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OFF THE RECORD

Memoes From Aviation Week's Staff

Cleveland, O.

To Bob, Mick & Bill:

Thought you'd want a short FYI on the inspection party NACA put on here at its Lewis Lab. They had some 1500 visitors, mostly industry & military, and a few press. Of course we've already run our main news story but here are a few off-the-record observations. Looked to me like NACA has pulled in its horns quite a bit on specific facts. Maybe another product of HST's confusing sound-off on security. But once we got the idea that it was more a demonstration of "HOW WE FIND THESE THINGS OUT" than a release of "THIS IS WHAT WE HAVE FOUND OUT," it was time well spent.

If you remember the old theory that research is about three years ahead of present-day stuff, there's a lot of progress ahead in the next three years. The NACA'ers are concerned most about ram jets and rockets in their advanced thinking now. Tho they do have a number of fellows worrying around about some quick solutions to turbojet shortage problems. Such ideas as cooling the blades and the ~~fir~~ discs, and using less strategic metals that have been heat-treated, and using ceramels, are being offered to the engine industry as production-ready solutions.

The real, long-haired scientists here don't pay much attention anymore to the transonic speed range. It's just something you go through as you gain your cruising speed.

They showed us a 16-inch diameter ramjet in the new 8 by 6 ft. supersonic wind tunnel, and their altitude test facility is capable of testing ramjets up to ~~24~~ 35 in. diameter, at speeds up to Mach 3, at temperatures of minus 70 deg. F and altitudes simulated up to 60,000 ft. It looks like the 35 in. diameter may be the practical limit for the immediate future, but how much larger the ramjets will go is anybody's guess. It's a safe bet that we are going to see a lot of ramjets on the tips of some really big copter rotors, as well as in missiles, and the ramjets seem to have a little more future as airplane powerplants than I had previously supposed.

From the way some talk out here, it looks like the next major step in powerplants will be a turbojet with a supersonic compressor combined with a very efficient afterburner. This combination will enable any airplane to get up to velocities fast enough so that the ramjet effect of the afterburner with its tremendous added thrust can be cut in at speeds where it will be much more efficient than it is at subsonic velocities. Operating speeds up to 1500 mph, at least, appear to be in the cards for planes powered like this.

Incidentally, it was amusing to see a big silhouette drawing of a plane powered by turbojet with afterburner, in a demonstration of afterburner future prospects. Nobody said so, but it looked very much like the installation of the new Westinghouse J-40 in the new Navy McDonnell ~~XF3H~~ XF3H Demon carrier fighter. Oh, yes; I got to handle the throttle feeding gas to the 16 in. ramjet in the wind-tunnel...An NACA-accredited ramjet operator now!

Alex McSurely

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Agency—Fuller & Smith & Ross, Inc.

BARBER COLMAN COMPANY 24
Agency—Cummings, Brand & McPherson Adv.

B. G. CORPORATION, THE ..... Front Cover
Agency—Buchanan & Co., Inc.

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BRILES MANUFACTURING COMPANY 66
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Agency—Wallace Mackay Co.

CHAMBERLAIN AVIATION, INC. 34, 50, 67
Agency—Ralph Gross Adv., Inc.

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ELASTIC STOP NUT CORP. OF AMERICA ..... Fourth Cover
Agency—G. M. Basford Co.

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GENERAL CONTROLS CO. 50
Agency—Hixson & Jorgensen, Inc.

GENERAL ELECTRIC COMPANY 6
Agency—G. M. Basford Co.

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Agency—Richard T. Brandt, Inc.

HARTMAN ELECTRICAL MFG. CO. 58
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SEARCHLIGHT SECTION 69, 70, 71, 72, 73, 74, 75

SINCLAIR REFINING CO. 40, 41
Agency—Morey, Humm & Johnstone, Inc.

SPERRY GYROSCOPE COMPANY ..... Third Cover
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EMPLOYMENT
Positions Vacant 69, 73
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EDITORIAL

They Didn't Wait for Subsidy

That pugnacious, fighting, Flying Tiger, Robert W. Prescott, has just announced "the largest single purchase of new cargo planes" the air transport industry ever saw.

His Flying Tiger Line has ordered seven DC-6As to the tune of some $7 million or more. The Tigers boast they already run the world's largest freight and contract air fleet, and this new purchase will give them 44 planes. He hints at still other purchases:

"In the past year, we doubled the size of our fleet and our traffic tripled, rising from $5 million to nearly $16 million. That increase in fleet enabled us to meet an important part of the transport demand placed upon us by the expansion of the nation's military and industrial programs. With the addition of the DC-6A, plus other equipment which we may acquire in the meantime, we will be in an even better position to meet the steadily growing demands that exist in all parts of the world for freight and contract air service."

Those who contended so vigorously a few years ago that air cargo's future was a mirage must have been confused to read the other day that the Flying Tigers earned nearly $1.4 million in the fiscal year ended June 30. Furthermore, the Tigers' gross revenues in August hit $1,973,000. That's a lot of business for an air transportation company certificated Aug. 2, 1949, to carve out for itself in non-subsidy money in a field that didn't even exist 10 years ago.. That, gentlemen, is selling!

Even so, it doesn't require much of a memory to recall when Prescott told a Senate committee looking into mail subsidies earlier this year: "We are having to fight for every inch of the air through which we fly against the combined and bitter opposition of the entrenched passenger carriers."

Private initiative and bull-headed determination by men like Prescott and Earl Slick—who is already taking delivery of DC-6As—gave air cargo its birthright in this country. We are among observers who have always believed that air cargo's potential exceeds that of the air passenger business.

Douglas Aircraft Co. has proven convincingly that it has similar faith in air cargo's future. This company's initiative created the DC-6A, the first transport whose fuselage has been specially designed for cargo. It then later adapted this bigger DC-6 to passenger purposes, with the DC-6B designation. But the A flew first—late in 1949.

Douglas did not sit twiddling its thumbs waiting for Uncle Sam to dole out subsidy millions to build a bigger, faster, more modern cargo carrier. Despite uncertain business conditions of the 1948 era, Douglas went ahead on the DC-6A.

It was a typical American business success story that we don't read about in aviation as often as we should. After Douglas was far along with the project, the Air Force saw the value of the A and placed an initial order for 29; the Navy placed an order too. Commercial orders for both Models A and B have been forthcoming in a steady stream, so that Donald Douglas told stockholders in the most recent annual report that the firm's development costs "have thus doubly been justified by both commercial and military commitments." He added, "I am confident that management's decision to go ahead with the DC-6A was sound and timely in the present emergency."

So the pioneering freight lines and military services have the benefit of a plane that is not just a handsome engineering drawing somewhere in a confidential prospectus, but a big, fast transport—as the Douglas company says—"in large-scale production and capable of being still further accelerated to meet increased military and commercial demands."

Both the Flying Tigers and Douglas Aircraft are proving that commercial risk-taking on a sound project can still pay off.

Being Realistic Is Difficult

In AVIATION WEEK's lead news story Oct. 15 we reported that "unrealistic" military aircraft production schedules were to be cut.

One or two second echelon Air Force officials took a dim view of our phraseology.

So last week our military editor, reporting both the coming cuts and "the other side," wrote in another lead story:

"According to (Undersecretary) Gilpatric, USAF is not rescheduling programs to more realistic proportions. There is no need for such a move, he says, because schedules are already in harmony with the military needs. Rather, he states, Air Force is revising delivery schedules in keeping with current and projected industry output capabilities."

We'll leave it to you: Who's realistic?

It's Unpatriotic to Hurry?

Special pleaders sound the same in any business. A gigantic close-up view of the trees obscures the forest.

The New York Herald Tribune says shipping interests are interpreting a recent State Department order telling its personnel to travel by air instead of ship as a policy "directed against the American Merchant Marine."

The ship men say this conspiracy between the State Department and aviation interests to save time and money is dangerous "because we know better than anyone else what ships mean to our nation when we come face to face with emergency."

We are for the strongest Merchant Marine our military services want. If more subsidies are needed so it can do the necessary war job, then we should hand the subsidies over.

But if we come "face to face with emergency" we don't want our VIPs conducting the war at a 15-to-30-knot tempo. We don't think the American people do, either.

—Robert H. Wood